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ELECTRICAL REVIEW

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The Electrical Industry in Time of War

THE present critical situation in regard to our international affairs finds the electrical industry ready and willing to do its share. Already many organizations of electrical men and a great many individual companies have pledged their support to the administration, and it is very gratifying to note the large number of prominent electrical men who have been called upon, either in an industrial or an engineering capacity, to help direct the preparedness program now actively under way.

An indication of the times is the action taken by the copper producers in voluntarily agreeing to supply the Government with all of the copper required for the army and navy at a price of about 17 cents per pound, which, at the time of writing, is just one-half of present market prices.

As noted in our last issue, approximately 50,000,000 pounds of copper will be supplied at this price during the next 12 months. Figured conservatively, this represents a saving equal to the annual interest on a bond issue of $200,000,000. Equal patriotism has been shown by many of the largest and most prominent electrical manufacturers who have offered to turn over for Government use, *without profit,* their entire organizations.

As already noted in these columns, the central-station industry has been prepared. Already mobilized, ready to serve the individual, the community and the nation, whether for peace or war, solidly and surely founded, it stands, not the creation of a moment's hasty, frenzied action, but the evolution of wise, far-sighted policy, careful and painstaking development and judicious fostering. Long since have intensive co-operation and unified effort been the key note for the cheap and reliable generation, transmission and utilization of electrical energy. Increased outputs, overloads, long hours and overtime are the order of the day. The solution is to resort to central-station service in the vicinity of arsenals, fortifications, army posts, navy yards, etc. It is available without costly delays and without the necessity of finding extensive capital which in any case can be better utilized in other ways.

While industrial preparedness is, without doubt, of vital importance, the country is sorely in need of men for active service. The President has recently issued orders for the recruiting of the United States Navy to its present authorized war strength of 87,000 men, which will require immediate enlistment of about 25,000 recruits. The idea is to bring the first line of national defense up to condition of immediate maximum efficiency. In this work also can the electrical industry be of inestimable service to the country. On other pages of this issue there is presented a brief resume of the opportunities for electrical work in the navy. Employers are undoubtedly sorely taxed to keep the number of employees abreast of the demands in their factories; nevertheless, it would be a wise and far-sighted policy on their part to encourage enlistment for the younger men, such as apprentices, since, aside from patriotic considerations, the training is a very good one and the men return much better able to take their places in the electrical industry.

Another phase of the preparedness program is open to electrical dealers, namely that of maintaining window displays designed to encourage enlistments. The cause is a worthy one, and the dealer who so participates gains prestige in his community and must necessarily gain satisfaction from the knowledge that he is doing his part.

Power Requirements of Rock-Crushing Plants

IN this issue we publish an exceptionally valuable article on the size and characteristics of motors for rock-crushing plants which we believe will be found of considerable service by central-station men. There are now a great many opportunities throughout the country for supplying electric power to industries which involve the quarrying and crushing of rock, both mineral and non-mineral. In the mining districts of the north, west and south this calls for the consumption of a large aggregate of kilowatt-hours supplied from the transmission systems of the large hydroelectric companies such as the Colorado Power Company, Utah Power Company, Washington Waterpower Company, Montana Power Company and others of similar character and extent. Probably the largest individual groups of crushing machinery driven by electric motors are comprised within the territories served by such systems.

But it is not alone among the large mining plants that very considerable opportunities exist for the use of electric power in driving crushing machinery. Scattered throughout the length and breadth of the country are thousands of quarries and commercial rock-crushing

and screening plants, cement mills, gypsum mills, phosphate and other fertilizer plants, and numerous industries which depend for their raw material upon the rock formations in their vicinity. Nearly all of these are so situated that they can secure energy to advantage.

With one of the conclusions reached by the author of the article we are forced to disagree. He says,"The opportunity to use the direct-current motor being so limited it has been purposely omitted in this article." Taking the country as a whole it will be found that in many places direct-current systems are in use by numerous industries which involve crushing, and in such cases they can be very readily supplied with direct current either, as in some cases, with a trolley line in the vicinity or through a rotary converter or motor-generator set at the plant where the energy is used. The application of direct-current motors will not very materially alter the horsepowers given in the table which accompanies the article, inasmuch as the latter are only approximates and will be governed by conditions of service prevailing in the place where the power is used.

We commend this article to the attention of our readers among central-station managers who are looking for further opportunities to extend their commercial power service.

Electrical Fixture Models For Other Illuminants

A TRITE and tested saying has it that imitation is the sincerest flattery. This maxim is particularly apt with respect to the electrical industry, whose imitators in other lines of activity are numerous and assiduous.

An example that comes readily to mind is the habitual trailing of our friends in other lighting industries. In the design and manufacture of fixtures, lamps and shades, this is especially evident. Electrical lighting equipment furnishes a multitude of models for lighting devices of another kind.

Not only are electrical developments copied because of their inherent efficiency as light producers and diffusers; an added motive is in the fact that they lend to inferior forms of illumination some of the external appearances of being electrical in their nature. One has noted wall brackets, indirect and semi-indirect pendent bowls, and inverted fixtures of various types, which were evidently suggested as to their form and structure by lamps primarily designed for incandescent electric lighting; while some of the so-called inverted arcs at first glimpse are liable to delude "the very elect." Table lamps are being produced on distinctly electric models, scarcely to be distinguished from them, save by the sense of smell. Even technical terms usually regarded as peculiarly electrical are being borrowed to apply to characteristics of other kinds of illuminants.

This is not written with the aim of disparaging any other types of lighting other than electric, but to call attention to the high regard in which the latter is held, even by ambitions competitors.

Analyzing Construction Costs

NO more important work can be done by the central-station engineer than the analysis of construction costs on his property when work of significant character is undertaken. In the rush of providing equipment for new-business demands, many costs are apt to be overlooked as individual components of the entire job outlay, so far as subsequent unit analyses are concerned. For this reason it is desirable to carry the process of segregation to as much refinement as the local conditions permit, and the engineer who follows such work closely is sure to be rewarded.

For example, a central station may extend its plant and along with this work may go the construction of a garage for company use and perhaps the reconstruction of certain outgoing line terminal facilities and the enlargement of the coal-handling installation and storage yard. The engineering department will doubtless have made the orthodox estimates of the outlay for this work, and in a well-run company, these estimates will be subdivided with considerable skill. Now it is not enough that the actual cost of the job in the field, taken as a whole, shall fall within the resulting appropriation, looking at the matter from the engineering point of view. The management and the stockholders may not care a discarded carbon lamp bulb about the variations actually occuring in the field between engineering estimates and labor and material outlays; but this is no way for engineers to consider the matter.

It very often happens that however carefully estimates may be made up and segregated in advance of the construction work, the course of the installation will vary somewhat from what was expected. Materials may be late in arrival, or conditions may require completing one part of the work ahead of another part; or again, two apparently unrelated parts of the job, as in concrete-foundation construction, may be advantageously finished at the same time and handled in co-ordination from the beginning, for that matter. From the records of the timekeepers and stock clerks, therefore, it may be very difficult and perhaps impossible to draw up cost sheets in the field along the line of the estimate classifications, and hence the checking of the estimates in extenso, may have to be foregone. Now if the engineers keep a sharp watch upon these variations from the expected program as the work proceeds, they may be able at least to segregate costs in a way that will still give the company valuable information, even if it does not exactly measure up in classification to the standard of the estimate. The closer the work is followed, with access to purchase and pay roll data, time required to perform this or that task, the more the engineer will get out of it, and above all, he will be able to separate vital costs applying to unrelated parts of the work carried on synchronously in such a way as to provide himself and his associates with data of the utmost subsequent value.

HAPPENINGS IN THE INDUSTRY

Minnesota Association Considers Many Important Topics in Annual Convention—B. J. Arnold Discusses Financial Aspects of Chicago Traction Plans—Co-Operation Between Jobbers and Utilities Urged—Plans for N. E. L. A. Exhibition Completed—Commission to Study Jovian Problem—Wissota Plant Dedicated—Municipal Ownership for St. Louis Opposed.

CENTRAL-STATION OPERATION CONSIDERED FROM MANY DIFFERENT ANGLES.

Electric Cooking and 24-Hour Service Among the Chief Topics at Tenth Annual Convention of Minnesota Electrical Association.

The first session of the convention was called to order Tuesday morning, March 20, at the St. Paul Hotel, St. Paul. In the absence of President Kemper, Vice-President Haney presided. During the morning session the report of the secretary and treasurer was read, and the reports of the various committees were also heard.

At the afternoon session Acting Mayor McColl, of St. Paul, gave an address of welcome to the visiting delegates. A paper entitled "Construction, Maintenance and Inspection of Distribution Systems," by S. B. Hood, of the Minneapolis General Electric Company, was read by L. Kachel. In his paper Mr. Hood called attention to the necessity of carefully investigating the possibility of making new pole-line extensions, owing to the present high cost of materials. He also emphasized the fact that small generating plants should not be installed in small towns, if it is possible to purchase energy in bulk transmitted a reasonable distance from some other power development. He also discussed in detail various forms of secondary distribution systems, and showed how to make an analysis of the same. He also took up in detail the operation of the four-wire, three-phase system.

E. H. Adler, of the Westinghouse Electric & Manufacturing Company, read a paper on "Electric Cooking." This paper elicited a lively discussion, as it is one of vital interest to many of the central-station companies of Minnesota. The afternoon session closed with a film entitled "Romance of an Old Style School," which was furnished by the Westinghouse company.

The third session opened Wednesday morning with a paper entitled "Twenty-four Hour Service in Towns of 1,500 Inhabitants or Less," which was presented by Earl D. Jackson, consulting engineer of St. Paul. Mr. Jackson spoke about the possibility of furnishing 24-hour service, discussing in detail the merits of internal-combustion engine plants, steam plants, storage-battery systems and the plan of purchasing energy from a transmission line. He showed the cost of generating energy in the various kinds of plants.

Mr. Barnert, of Minneapolis, read a paper on the "Effect of Load-Factor on Operating Cost, with Special Consideration of Desirable Customers and City Pumping." This paper considered the hydroelectric plant and the steam turbine plant for a standby. He showed in detail how the load-factor varied in the different plants of the Northern States Power Company, and how city pumping loads affected the load-factor. The paper was followed by the exhibition of a motion-picture film entitled "Kings of the Rails," which showed the development of an electric locomotive. This was furnished by the General Electric Company.

At the afternoon session Professor George D. Shepardson, of the University of Minnesota, read a paper on "How the Central Stations Are Making More Use of Technical Schools." Professor W. T. Ryan, of the University of Minnesota, then read a paper entitled "Principles of Rate Making." Professor Ryan went into great detail regarding the different items which enter into the cost of generating electrical energy. He mentioned the three principal features involved in rate making, the energy charge, the capacity charge, and the consumer charge, and he explained in detail what these items meant.

During the morning session of March 22, W. A. Durgin, of the Commonwealth Edison Company, Chicago, presented a paper entitled "Lighting—a By-Product or a Buy-Product." Mr. Durgin's lecture was illustrated by means of miniature houses, and the effect of different forms and intensity of lighting was shown.

The election of officers for the ensuing year resulted as follows: President, F. A. Otto, Albert Lea; first vice-president, E. J. Fleming, Red Wing; second vice-president, E. Aveldson, Litchfield; secretary and treasurer, H. E. Young, Minneapolis; executive board, F. A. Otto, H. E. Young, B. M. Howard, H. Swanson and T. C. Gordon.

One of the features of the entertainment program was a banquet given by the electrical jobbers of the Twin Cities to the delegates in attendance at the convention.

FINANCIAL ASPECTS OF THE CHICAGO TRACTION AND SUBWAY DEVELOPMENT PLANS.

Address by Bion J. Arnold, of the Chicago Traction and Subway Commission, Before Electrical Engineers in Chicago.

At the meeting held on the evening of March 26 jointly by the Western Society of Engineers and the American Institute of Electrical Engineers, an address was made on "The Financial Plan of the Report of the Chicago Traction and Subway Commission," by Bion J. Arnold, member of the commission. The very comprehensive report of this commission, which was recently submitted to the City Council, was first reviewed briefly by Mr. Arnold. The commission was asked to make a complete study of urban transportation and to recommend an extension of existing lines and construction of new rapid transit and feeder lines with the idea of having the entire surface, elevated and subway system operated as a single unified system. As mentioned in earlier issues, the commission recommended a comprehensive set of improvements, extensions and new construction work involving an investment within the first nine-year period of nearly $100,000,000 and within the two following nine-year periods of an additional $180,000,000.

Taking up the financial features, Mr. Arnold stated that the present valuation of the surface lines in the city was about $150,000,000 and that of the elevated railways about $70,000,000, making the present properties of a total value of about $220,000,000. It is estimated that if the improvements were made as suggested by the commission the total investment at the end of about 30 years would be nearly $500,000,000. The commission recommended that the consolidated company be allowed six per cent upon the present investment and 45 per cent of the net receipts after making all allowances for operating charges, depreciation, interest, amortization, etc., the city receiving 55 per cent of this divisible net, as is the case under the present or-

dinances under which all of the Chicago surface lines are operated.

It was recommended that the new capital invested by the company should be allowed only that interest which had to be paid in order to secure it. The maximum return allowed to the company is eight per cent on its actual investment. All subway construction proposed is to be paid for from the city's traction fund, which now amounts to about $20,000,000, and from additions to this fund. It is planned that the city should also receive six per cent interest on this fund or as much of it as was actually invested in the properties. An amortization fund is to be established about five years after the plan goes into effect, which will be used to gradually retire the investment. With the increasing investment from the city's traction fund, together with the amortization funds, it was anticipated that the private investment by the company would be entirely extinguished about 1957, so that at that time the entire property would come into the complete ownership of the city without having raised a single dollar through bond issues or taxation.

The paper was discussed by F. F. Fowle, Mr. Batchelder, G. T. Seely, P. Junkersfeld, J. R. Bibbins, J. W. Mabbs, E. N. Lake and many others. Mr. Seely spoke of the traction and subway developments of Boston, New York City and Philadelphia, showing that in each of these cities it had been found necessary for the city to participate actively in the construction of subways and also necessary to make long-term contracts with the operating companies. He felt that the plan proposed for Chicago was unique in that it permitted the city to come into complete possession of the entire property in a period of about 40 years without having expended any funds of its own for the purpose.

MORE HARMONIOUS RELATIONS BETWEEN JOBBERS AND UTILITIES URGED.

Meeting of National Electric Light Association Executive Committee Acts on Suggestion of Jobbers for Greater Co-operation—Final Committee Reports Presented.

At the meeting of the Executive Committee of the National Electric Light Association held in New York, on March 9, a committee of the National Electrical Supply Jobbers' Association, headed by E. W. Rockafellow, of the Western Electric Company, urged that there be greater co-operation between the central-station industry and the electrical jobbers. Judge Debevoise, in behalf of the jobbers, explained the position they occupy in the field and enumerated the advantages to central-station interests which would result from a closer co-operation. As a result of this conference President Wagner, of the National Electric Light Association, authorized the chairman of the Commercial Section to appoint a sub-committee to meet with a similar committee from the jobbers to work out a definite program.

Reports of various committees were presented showing that rapid progress is being made in completing reports for the forthcoming annual convention to be held at Atlantic City.

President Wagner stated that the Exhibition Committee has completed its plans for the convention exhibition, which is to be more educational in nature than heretofore. The committee has been authorized to award three prizes for the best papers written by central-station employees, descriptive of the exhibition.

Walter Neumuller, who has made a special campaign for new members, presented a report showing that there are 28 prospects for Class A members of the Association in cities of over 10,000 population, and 252 in cities between 2,500 and 10,000. An executive of the nearest member company has been asked to call on each prospect for the purpose of interesting the company in membership.

PLANS FOR N. E. L. A. EXHIBITION COMPLETED.

Special Efforts Made to Make Displays of Real Educational Value.

The Exhibition Committee of the National Electric Light Association has about completed all details in regard to the exhibits and expects to have the details complete within a few days covering the decorations which, if present plans are carried out, will be unique in many respects.

The Lamp Committee has completed its plans and will make the most comprehensive exhibit of incandescent lamps and their applications ever displayed at any convention, in the space assigned them in Exhibition Hall immediately adjoining the meeting rooms. Besides the Lamp Committee, the Lighting Sales and Power Sales Bureaus, as well as the Commercial Section, are taking unusual interest and co-operating in every way possible with the Lamp Committee to make this the most complete exhibit ever shown at a convention.

The National Executive Committee is very anxious that each exhibitor plan some educational feature for his exhibit—something that will be working or will show a development of some kind in connection with the industry that will be a little different from the ordinary display usually shown at conventions. A development of this kind should add much to the individual exhibit as well as to the convention as a whole, and it is hoped by the committee that each manufacturer will endeavor to do something along these lines.

The location of the meeting rooms which makes it necessary for the members to pass through the exhibits to get to same should add much to the success of the exhibits, which is evidently being considered from the number of applications already received.

The Exhibition Committee has secured almost double the space used in previous years, but from present indications the space will be limited again this year.

The Electric Vehicle Section is located at the front of Exhibition Hall, facing and with a full view of the boardwalk, making it one of the most important positions on the pier.

The exhibits will be completed Saturday night, May 26, and the exhibition opens Monday morning at nine o'clock with special ceremonies.

IOWA ELECTRIC UTILITIES INVOLVED IN CONSOLIDATION.

Iowa Southern Utilities Merges With David G. Fisher & Company.

A merger of public utility plants was effected in Davenport when the Iowa holdings of David G. Fisher & Company, were consolidated with the Iowa Southern Utilities Company, with headquarters at Centerville, Iowa, and owning extensive interests in the southern part of the state.

The Fisher company's counsel in the big consolidation has been Attorney Joe R. Lane, of Lane & Waterman.

The consolidation brings properties, the physical valuation of which is conservatively estimated at over $2,000,000, under the control of that company. The Fisher properties merged by the consolidation are the Leon Electric Company, Clearfield Electric Company, Lennox Electric Company, Blockton Light & Power Company, and Mt. Ayr Light & Power Company. These companies have furnished electric light and power to 14 towns with a population of 14,000 in southern Iowa, covering Decatur, Ringgold, Taylor and Lucas Counties.

The David G. Fisher & Company interests were organized in Davenport three years ago. The company has had a rapid expansion since that time. It operated electric light and power plants in Minnesota and other states in addition to the Iowa properties.

COMMISSION TO STUDY JOVIAN PROBLEMS.

Meeting to be Held in Cleveland to Discuss Ways of Improving Relations with Local Leagues.

At the annual Jovian convention held in Indianapolis, Ind., last October, a resolution was passed authorizing Jupiter to appoint a commission to meet at some central point for the purpose of devising ways and means to improve the existing relations between the Jovian Order and local electrical Leagues.

Reigning Jupiter Doherty, acting upon the suggestion of the convention, has appointed Mercury Ell C. Bennett, as chairman of a commission organized for the purpose expressed, to meet at Cleveland on April 3.

The Cleveland Electric League offered the use of its club-rooms as a meeting place for the commission, and the offer was accepted. These rooms are located on the top floor of the Hotel Statler.

The organization of the commission is now being prosecuted and it is assured that it will be composed of not less than seven men, each representing some one of the larger Jovian centers where a league is at present actively operating.

In addition to the members of the commission bringing to the meeting the thoughts of their respective communities, a call has been sent to every electrical League, and to every city having a large Jovian membership whether or not a League is in existence there, to either send a representative to confer with the commission, or to submit their views in writing.

It is hoped and believed that with the information and ideas that are concentrated in this manner for the benefit of the deliberations of the commission, that it will be able to offer a definite, practical, immediately-workable plan that will solve the major problems that are now preventing the best progress of the Order and local Leagues.

If the findings of the commission include changes that will require amendments to the existing Jovian constitution, and congress (which meets with the commission), agrees, a special meeting may be called at the earliest possible date, possibly in May, to enact the needed legislation. The constitution makes this possible upon 30 days' printed notice to all Jovians in good standing, provided a quorum is present at the meeting at which the amendments are passed.

WISSOTA PLANT OF WISCONSIN-MINNESOTA COMPANY DEDICATED.

New 45,000-Horsepower Project to Supply Energy to Number of Important Towns.

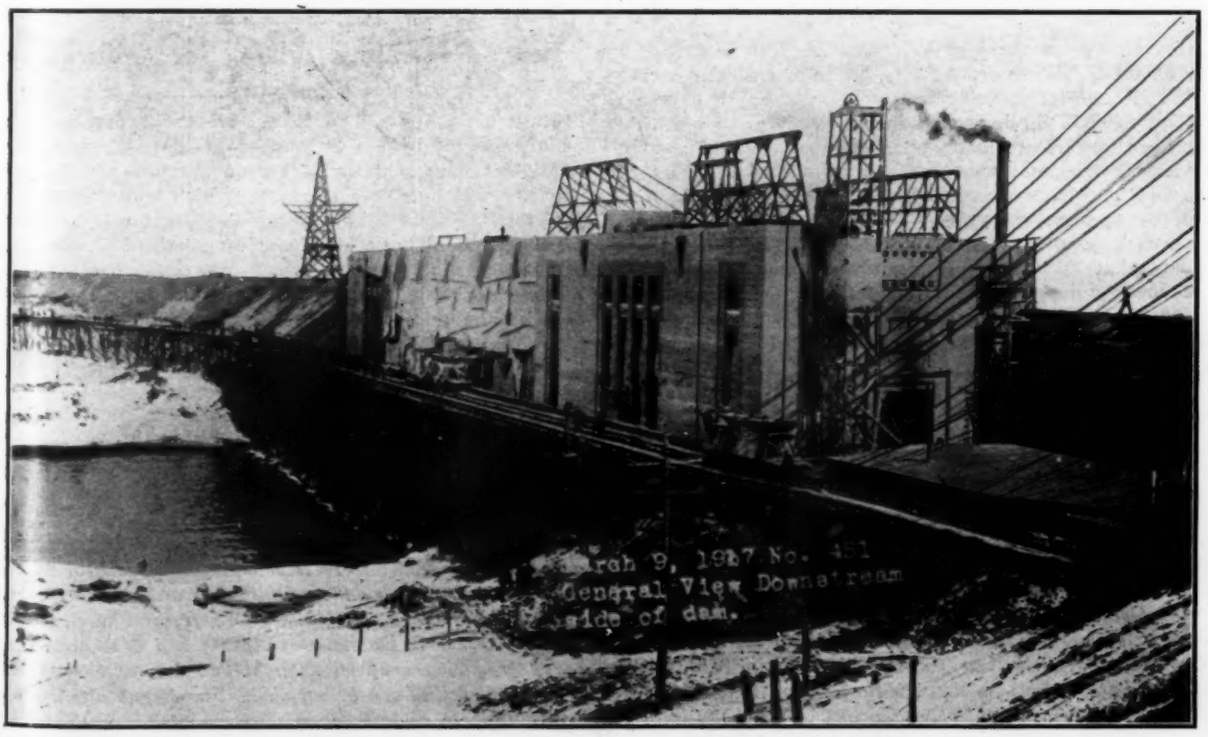
The new 45,000-horsepower hydroelectric plant of the Wisconsin-Minnesota Light & Power Company, located on the Chippewa River, about two miles above Chippewa Falls, Wis., was recently dedicated in the presence of city officials of Eau Claire and Chippewa Falls civic bodies, and employees of the power company.

The dam, construction of which was started October, 1915, has caused the formation of a lake covering 7,000 acres of land. The highest flood waters ever recorded in the Chippewa River, multiplied fourfold, would not try the resisting power of its concrete walls should all the smaller dams which curb the stream above, burst simultaneously. Inasmuch as the head of the water is 184.3 feet above the level of the city of Eau Claire and 167.4 feet above the city of Chippewa Falls, all possible precautions have been taken to insure structural strength.

The head of water at the dam itself is 58 feet. Seven generators, each of 6,500 horsepower, generate the energy. In the spillway are 13 Staurweike gates to regulate the flow.

All adjacent territory in Wisconsin and Minnesota will be served with electricity from the Wissota dam, but the builders, in accordance with their avowed purpose of developing the resources of this particular portion of the northwest to the utmost, will dispose of all power possible near at hand.

One hundred miles of transmission line, 72 miles of which, from a point near Chippewa Falls to the St. Croix River, is laid in as nearly a straight line as engineering methods can accomplish, convey energy from the power site to the Twin Cities.



Wissota Plant of the Wisconsin-Minnesota Light & Power Company on Chippewa River Which Was Recently Dedicated.

CITY EXPERT OPPOSES MUNICIPAL PLANT FOR ST. LOUIS.

Survey Shows City Plant Would Cost in Excess of $5,000,000 and Tax Payers Would Have Heavy Burden.

In a preliminary statement regarding the findings of the committee in charge of a survey now being made to determine the feasibility of establishing a municipal lighting plant to serve the city of St. Louis, Director of Public Utilities Hooke, who is in charge of the survey, said that the city of St. Louis could accommodate but a single lighting plant, the cost of which—according to estimates and tabulations already prepared—would run very much in excess of $5,000,000.

The most important factors which have thus far been disclosed by the survey are (1) that a municipal plant would have to be constructed on a basis of meeting competition of The Electric Company (Union Electric Light & Power Company), and that to do so would entail very extensive construction which would involve particularly heavy expense on account of the city regulations requiring the underground installation of service and distribution lines; (2) that if a municipal plant is installed on such a competitive basis it will result in the ultimate elimination of either the present company or the proposed municipal plant, the process in either event probably resulting in financial loss to the city; (3) that on account of the heavy overhead burden it would be unwise to install a service to supply only the street-lighting system of the city; (4) that the construction at this time of a limited-capacity plant with later piece-meal extensions and additions would in all probability prove to be a disastrous financial experiment to the city.

Part of the survey is based on the practicability of locating a central distribution station on the Levee on account of the economical pumping and water transportation facilities.

The survey, for which the Board of Aldermen appropriated $12,500, will probably be completed in two months.

NEW ENGINEERING SOCIETY ORGANIZED.

Southwestern Society of Engineers Holds First Meeting in Texas.

At a convention held in El Paso, Tex., on March 8, 9 and 10, the Southwestern Society of Engineers was organized with more than 100 charter members. Membership is open to civil, mechanical, mining, electrical or chemical engineers, or architects or other persons belonging to a technical profession, who are not less than 27 years of age, and who have been in active practice of their profession for at least six years. Provision is also made for associated, honorary and affiliated members.

The great distance from centers of population makes it difficult for southwestern engineers to attend meetings of the national engineering organizations, so it is believed that the new Society will fill a real need. It is planned to hold at least two conventions of the Society each year and for the reading and discussion of professional papers and for social intercourse.

At the first convention the following papers were read and discussed: "The Purpose of Engineering Education," by Dean G. M. Butler, College of Mines and Engineering, University of Arizona. "Some Lessons Taught the Mining Industry of the Southwest by Present Activities and Prices," by Gerald Sherman, superintendent of the Copper Queen Consolidated Mining Company, Bisbee, Ariz. "Modern Highways and the Dividends They Pay," by J. L. Campbell. "Engineering and National Defense," by Lieutenant-Colonel M. L. Walker, U. S. Army.

The officers of the Society are:

President, Dean A. F. Barnes, School of Engineering, New Mexico College of Agriculture and Mechanic Arts.

Vice-president for two-year term, Dean G. M. Butler, College of Mines and Engineering, University of Arizona.

Vice-president for one-year term, Dean S. H. Worrell, Texas College of Mines.

Secretary, Forest E. Baker, El Paso, Texas.

Treasurer, R. W. Goddard, professor Electrical Engineering, N. M. College of Agriculture and Mechanic Arts.

Federal Control of Public Forest Land Sustained by Supreme Court.

In sustaining injunctions ousting Utah hydroelectric power companies from federal forest reservations, the Supreme Court has upheld federal and limited state sovereignty in developing resources in western "public land" states.

Regulations of the Agriculture and Interior Departments' conservation policy and decrees requiring the Utah power companies to remove their property from the public lands unless they obtain federal permits were sustained.

The court maintained power of Congress to regulate all public lands and denied that its authority was limited to lands actually used for federal purposes. All government regulations were not specifically upheld, but the court refused to disturb any of them. It also held that government was entitled to reasonable compensation from the Utah power concerns for use of lands occupied.

New Generating Plant for Milwaukee Company.

Construction of a new steam electric generating plant will be started by the Milwaukee (Wis.) Electric Railway & Light Company during the coming summer. The initial capacity will be 65,000 kilowatts, which will ultimately be increased to 200,000 kilowatts. The plant will be located on the shore of Lake Michigan just south of St. Francis, a Milwaukee suburb.

Three existing plants of the company in Milwaukee, as well as the purchase of 12,000 kilowatts of energy from plants on the Wisconsin River, will be continued.

The Commercial Possibilities of Filtered Light

By C. E. CLEWELL
University of Pennsylvania

BELIEVING that because of the present high efficiencies of incandescent lamps there is an appreciable field for the promulgation of color variations in lighting installations and that coincidently there is a need for a practical treatment of the subject that would tend to commercialize for the central-station industry the scientific research conducted by the National Lamp Works of the General Electric Company and others, we have arranged with Professor Clewell for a series of two articles on this important subject. The first article will appear in the issue of April 7 and deals with the methods of production, discussing comprehensively the methods of producing artificial daylight and otherwise modified light and its effect on the efficiency with which illumination of given intensities can be supplied. The second article will deal with methods of application and will embody information invaluable to central-station salesmen.

Miscellaneous NEWS NOTES

Municipal Plants Not Required to Report to Commission.—An unfavorable report has been accepted by the Connecticut House of Representatives on a bill which proposed to make municipal plants render a yearly report to the Public Utilities Commission.

Spokane Electrical Work Increasing.—A report of City Electrical Inspector W. A. Davis, of Spokane, Wash., shows considerable increase in the amount of electrical work being done in that city, 225 permits being issued in February. During that month 537 electrical inspections were made.

To Flood-Light National Capitol.—Plans are being made to install equipment for permanently flood-lighting the capitol building at Washington, D. C. It is proposed to place lamps to illuminate the entire building—dome, center and wings. The idea is the outcome of the lighting equipment provided for the inaugural period, which gained favorable comment.

Central Station Banquets Guardsmen.—Seventy employees of the Milwuakee Electric Railway & Light Company, members of the Wisconsin National Guard which recently returned from duty on the Mexican border, were tendered a banquet by the Electric Company's Employees' Mutual Benefit Association on March 24. General Manager S. B. Way addressed the soldiers. The company held the positions of all guardsmen open for them during their absence.

New Organization of Electric Power Men.—The Power Engineers' Society, comprising heads of the power department of central stations in Greater Boston and eastern Massachusetts, was recently organized. Its object is to enable members to exchange ideas that will be mutually beneficial. Davis M. De Bard, of the Brockton (Mass.) Edison Company, is head of the organization, which already comprises some 30 or 40 members. Meetings will be held periodically, usually in Boston.

Hydroelectric Company Projected in Connecticut.—A charter is being sought by the Quinebaug Power Company in Connecticut, which proposes to generate energy by water power and sell in bulk to the city of Norwich for distribution locally, and to manufacturing plants. Charles W. Comstock, the engineer behind the project, stated that it is proposed to construct a generating station at Lisbon, Conn. He believes there is a large demand for electric power for industrial purposes and that it can be provided at low cost by the proposed hydroelectric plant.

A Tribute to Edward N. Hurley.—"The man who has done more than anyone else to effect co-operation between the government and big business is Edward N. Hurley, late chairman of the Federal Trade Commission." In these words John J. Arnold, vice-president of the First National Bank, Chicago, Ill., speaking before the Advertising Association of Chicago, on March 22, paid a tribute to the untiring efforts of Mr. Hurley in bringing about first an understanding of the important position occupied by big business in the life of the nation and secondly the need for co-operation with the government.

Louisville Jovians Hear Preparedness Lecture.—Meeting at their regular luncheon recently, the Louisville Jovian League members heard, by their request, from Major George R. Spalding, United States Engineer at Louisville, as to how they could put their experience and abilities at the disposal of the government, in the way of preparedness for war. Major Spalding discussed the Federal Reserve Corps which is being organized by the government and dwelt particularly on the part that electrical engineers play in waging of campaigns. He invited members of the league to join the class he is conducting and take up the course of study which prepares for examination for a reserve corps commission. Several of the members of the league propose to take up the studies.

Maine Electrical Contractors Meet.—At a meeting and banquet of the Electrical Contractors' Association of Portland, Me., and vicinity, at the Falmouth Hotel, March 14, G. T. Fisher, the retiring manager of the commercial department, Cumberland County Power & Light Company, and A. C. Jordan, his successor, were the guests and were the recipients of toasts. Members of the organization supplied entertainment features.

Relief for Indigent British Engineers.—A committee of representative American engineers, including a very large percentage of prominent electrical men throughout the country, has issued an appeal to the members of the engineering profession in the United States to contribute to a fund for the relief of the families of engineers in Great Britain who are experiencing serious privation. Contributions may be forwarded to Lewis B. Stillwell, treasurer of this fund, in care of the Farmers' Loan & Trust Company, 475 Fifth Avenue, New York City.

Cleveland Section, A. I. E. E., Holds Interesting Meetings.—On February 26 H. L. Wallau, electrical engineer of the Cleveland Electric Illuminating Company, presented an excellent paper on "The Central Station's Share in Industrial Development," before a meeting of the Cleveland Section of the American Institute of Electrical Engineers, and on March 19 R. H. Rogers, of the General Electric Company, gave an illustrated lecture on "Electric Freight Handling in Terminals," before the same organization. The papers and the discussions brought out a large amount of interesting data profitable to the large number in attendance at both meetings.

Flood Lighting and Street Lighting to Be Discussed in New York.—Flood lighting and street lighting will be discussed at the April meeting of the New York Section of the Illuminating Engineering Society, scheduled for the evening of April 12 at the Engineering Societies Building, New York City. There will be two papers. R. B. Thompson, of the Central Hudson Gas & Electric Company, of Newburgh, N. Y., will describe installations of urban and suburban street lighting suitable for small cities. C. A. V. Halvorson, of the Lynn, Mass., works of the General Electric Company, will talk on lighting projectors, their development and uses. The usual custom of having an informal dinner preceding the meeting will be adhered to, the place being the Forty-second Street Grill, Forty-second and Madison Avenue. Visitors are cordially welcomed at these meetings, which from the standpoint of attendance have surpassed the records of the previous years.

Electrical Men Hear About Friendship Between Japan and United States.—At the meeting of the Electric Club-Jovian League of Chicago held on March 22, Saburo-Kurusa, Japanese consul at Chicago, spoke on the relations between Japan and the United States. He stated that ever since 1853 when Commodore Perry made his famous visit to Japan, as a result of which that country ceased its policy of isolation and began to develop in every way, the relations between the two countries have been most cordial. Mr. Kurusa showed that the various alleged differences that are being fomented by jingo newspapers in both countries are but minor issues that are easily capable of mutually satisfactory adjustment and require merely reaching a basis of understanding. He also showed that there is every reason why the two countries should maintain their friendship. Japan is very grateful for much that the United States has done in the Orient. Mr. Kurusa also looked forward to a more democratic diplomacy as one of the results of the war, which would mean that the foreign relations of countries would be more representative of the people and not only of the ruling classes, thus making the declaration of war more difficult.

Electric Cooking in Milwaukee

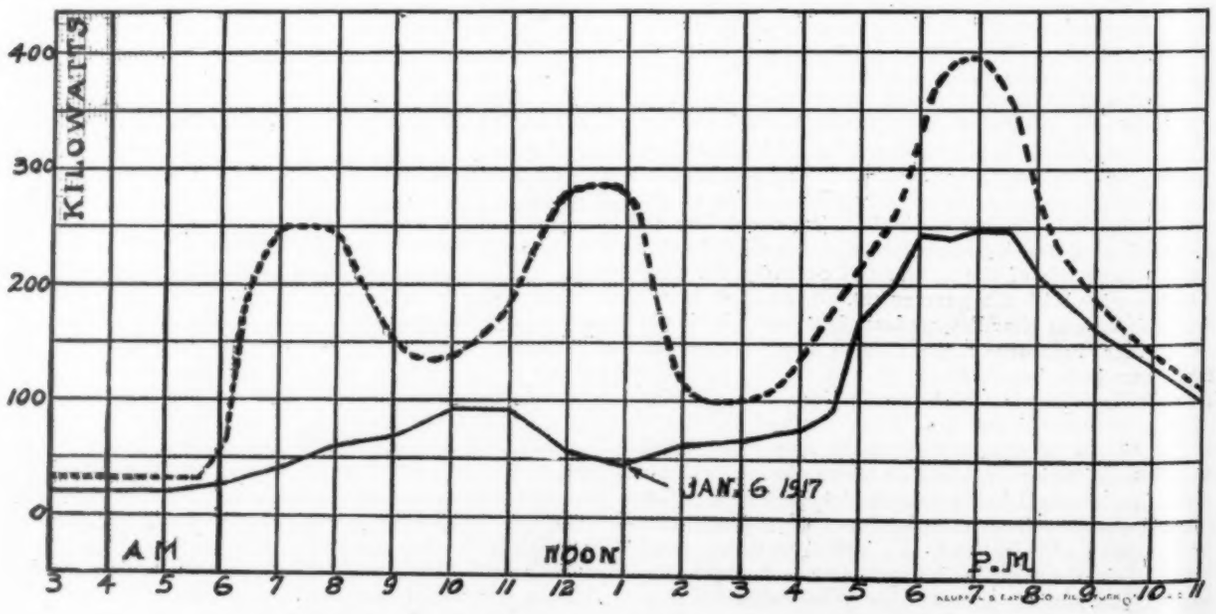
An Account of the Commendable Activities of the Milwaukee Electric Railway & Light Company in Promoting Electric Cooking and Some General Features of Range Campaigns—From a Paper Before the Wisconsin Electrical Association

By R. B. SNYDER
Sales Manager, Milwaukee Electric Railway & Light Company

ELECTRIC cooking has not as yet reached such a stage of development that the average prospective customer will purchase a range without the usual series of demonstrations required to convince the prospect that the range will really work and that the beautifully cooked food produced by the demonstrator without the customary smoke and muss was not placed in the oven, already cooked, by some slight-of-hand performance.

Public demonstrations at fairs, before women's clubs, in domestic science schools, and at the utility's display rooms, are rapidly removing any doubts as to the performance of the electric range and it will not be long before the concerted national advertising campaigns on electric cooking will prepare the public mind to accept electric cooking as a matter of course. But even with the prospect in that frame of mind, the service is not sold. The question of first cost of the range and cost of operation are bound to arise. The former depends largely on the manufacturer's price. It appears to be a common practice for the utility to sell the ranges at cost or a small profit and charge a fixed sum, such as $20, to cover the installation costs, permitting the customer to pay for the range on the installment plan, if desired. This makes the relatively high first cost less of a burden. As the demand for the ranges increases, the manufacturers will undoubtedly see their way clear to giving further impetus to their business, by making material reductions in prices. But it does not rest alone with the manufacturer, although his function of providing a reliable unit at a popular price is an important one. It is the function of the utility to provide a rate for electrical energy which will make possible an extended use of the range, supplanting all other methods of cooking. What such a rate must be, will depend to some extent on the cost of other fuels used for cooking, although such costs cease to be as large a factor after the many advantages of electric cooking are appreciated. It is generally agreed throughout the country that the rate for cooking purposes must be under five cents per kilowatt-hour. A compilation recently prepared by the Society for Electrical Development shows that there are 3,156 communities in the United States having cooking rates under five cents. Of these, 2,100 have a rate of four cents or less, and over 1,000 have a rate of three cents or less. In Wisconsin, there are 44 such communities. By far one of the most complete detailed analyses of electric cooking is that prepared by H. O. Schwaboda, a consulting engineer, appearing in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for October 14 and 21, 1916. This analysis covered 75 cities in 26 states, the population of the cities ranging from under 10,000 to over 1,000,000. Of the total number, 33 per cent had populations of 10,000 and under, and approximately 50 per cent of the companies operating in these cities had rates less than five cents per kilowatt-hour for 200 kilowatt-hours use per month.

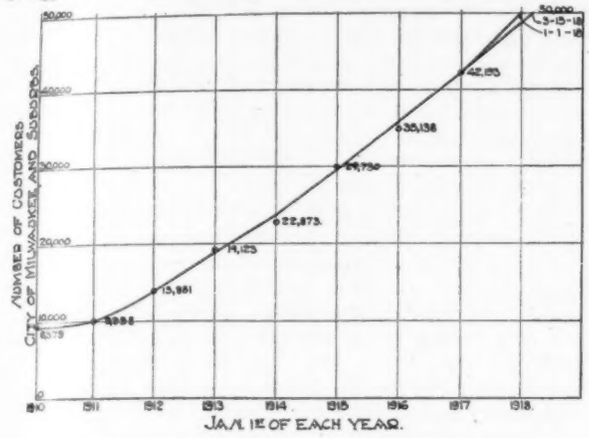
In selling cooking service, the customer generally wishes to know what the monthly bill will be. This involves an estimate of the kilowatt-hours used per month and this in turn depends upon the number of persons in the family. Data compiled for a number of cities indicates that a safe figure for the average family is one-third of a kilowatt-hour per warm meal per person, or one kilowatt-hour per day for each member of the household. This data checks closely with the average experience in Milwaukee. Al-



A Typical Residence Feeder in Milwaukee With An Assumed Range Load.

The dotted curve shows what effect a load of 500 electric ranges, 2250 kilowatts, would have on a typical residence feeder. A noon demand of 225 kilowatts is created, based on a diversity-factor of 10.

though with the form of rate in force, separate meters for measuring the energy used for cooking are unnecessary, a few were installed in order to separate the cooking energy from the lighting energy and make possible an



Curve Showing Increase in Number of Customers.

This curve shows the steady increase in number of consumers in Milwaukee and assumes that the 50,000 mark will be reached by January 1, 1918, when another reduction in rates will be made, in accordance with the policy of the company of reducing rates as the number of customers increase.

accurate study of the variations in use of different sizes of families.

Table I shows a record of the kilowatt-hours used for cooking by 20 customers during the first nine months of service. The customers chosen are representative, ranging in size from two to eight persons per household with four predominating as the average. The smallest use is that of customer No. 10 with 0.53 kilowatt-hour per person per day. The largest is customer No. 18 with a daily use per person of 1.88 kilowatt-hours. Such variations depend upon the size of the family and the habits of living. It is possible with careful operation, particularly by making fullest use of the stored heat in the oven for cooking food that otherwise might be heated on an individual hot plate, to improve the average results given in the table by a large percentage. But we are seeking the average results in order that the information be of use to the average prospective user. From all the facts at hand, there should be no hesitancy about using for estimating purposes, the average of one kilowatt-hour per day per person as such results can be achieved in any family.

The estimate of the customer's bill then becomes a simple matter of the application of the rate schedule to the quantity of energy to be used.

The present Milwaukee rate, which is based on "active" rooms, has a primary step of 10 cents for four kilowatt-hours for each of the first four active or counted rooms, and for 2.5 kilowatt-hours for all additional counted rooms, a secondary step of five cents for all energy over that paid for at the primary step up to a total of seven kilowatt-hours per counted room and a tertiary step of two cents for all energy consumed per month over seven kilowatt-hours per active or counted room. The rate is so designed that practically all the cooking energy is paid for at two cents per kilowatt-hour gross.

The application of this rate schedule to the consumption of a family of four persons with four active rooms using energy for lighting and cooking purposes is shown as follows:

First 16 Kilowatt-Hours at 10c equals	$1.60
Next 12 Kilowatt-Hours at 5c equals	.60
Next 120 Kilowatt-Hours at 2c equals	2.40
Total 148 Kilowatt-Hours	$4.60
Discount for Prompt Payment	.23
Net Lighting and Cooking Bill—combined	$4.37
Average Net Rate per Kilowatt-Hour	2.95c

From this example it will be seen that the lighting portion of the bill is $2.26, while the cooking portion is $2.40.

An Electric Cooking Policy.

Having reviewed briefly, various cost considerations that confront the average purchaser of electric cooking service, the following conclusions can be drawn.

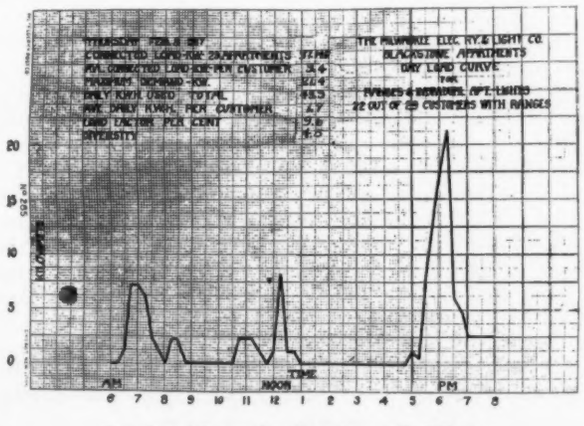
(1.) With the prevailing prices of electric ranges and the present development of the electric-cooking business, the utility should be prepared to offer a plan of sale involving a flat price for installing the range, to be paid upon installation, and installment payments for the range itself, to be paid with the electric service bill and spread over a period of a year or more, the total payment not to exceed the cost to the utility by any substantial margin.

(2.) With the present efficiency of electric-cooking apparatus, a consumption of one kilowatt-hour per day per person is a reliable average. With such efficiency, an energy rate of approximately three cents per kilowatt-hour will make electric cooking competitive with any other method of cooking in the average community.

(3.) The addition of a third or tertiary step to the usual two-step room rate for residence service, enables cooking and lighting service to be supplied through the same meter with minimum investment and operating expense, and appears to offer the most simple, economical, and sound basis of charging for electric service in the "all electric home."

Electric Cooking Service from the Utility's Standpoint.

We have considered at some length various practices which have been adopted and are being followed throughout the country in order to sell, electric-cooking service. Let us now consider the utility's viewpoint of this new service and endeavor to analyze its effect on the station peak, the load-factor, and the investment in distributing system. There is probably no subject in the electrical field concerning which so many guesses have been made or in connection with which so much poetic license has been taken by the various writers. The effect on the station peak of an installation of 20,000 ranges or a load curve on a residence feeder with 100 ranges has been as readily predicted in the past with little fear on the part



Day Load Curve for Apartment Building.

The experience of the Milwaukee Electric Railway & Light Company has been that the peak of the load curve for range customers in apartment buildings occurs in the evening.

of the author of being checked up by record of an actual installation.

The scattered sections in which the installations are usually made has rendered it more or less impossible for the average company with a few hundred ranges installed, to separate and analyze the effect of the range load, except in the case of apartment buildings. But as the data accumulates, there seems to be grounds for the first burst

of enthusiasm about the range business and we are finding, even with our present limited vision, that there is likely to be considerable truth to the predictions of high diversity of use, higher load-factor on the system, and other advantages resulting from an extended installation of electric ranges.

The individual maximum demand of single ranges may average between 40 and 60 per cent of the connected load. The maximum demand for a group of, say, 25 ranges, will not exceed 15 per cent of the connected load. Although no authentic curves for an installation of 500 ranges can be shown, it is predicted that the maximum demand of such a group will not exceed 10 per cent of the connected load or, as we shall speak of it here, the diversity-factor will be 10.

It is further expected that when the electric range comes into general use among all classes of customers, if the experience with gas cooking in the average city may be drawn upon, that the peak load for cooking will occur between 11:30 a. m. and 1:00 p. m., because many people have the principal meal in the middle of the day.

Range installations in apartment buildings cause entirely different load conditions then in the average home.

A large diversity-factor is obtained with apartment installations, but the peak load occurs between 5:00 and 6:30 p. m., as compared with the noon peak in the average residences. This seems to be the experience quite generally. It is probably due to the average family in the apartment being smaller than in the house, less likelihood of school children to provide with warm meals at noon, and the general tendency toward a canned and baker's bread existence, which the average small flat induces. Such conditions relieve the peak demand at noon and shift it to evening. As the apartment building falls easiest prey to the many charms of electric cooking, it is likely that the initial loads caused by such installations in large cities will not represent the average conditions which will prevail when all classes are using the service for cooking.

As to additional investment required to provide existing residence customers with capacity for range service, little has been written. Experience of one company in connecting 30 customers in Illinois indicates an average additional cost of $30 per customer, such costs, in most cases, being less than the original investment for lighting service from which only half the revenue derived from the cooking load, may be secured. To obtain comparable figures for the Milwaukee system, the costs of connecting 20 range customers were selected at random. Of these 20 customers, 10 were connected with no additional investment except that due to installing a larger meter; six were new customers and would have required line extensions if only for lighting service; and the remaining four installations required minor secondary extensions, transformer and meter changes. Even including the extensions for the new customers, which cannot be classed entirely as additional investment, the average total cost per range customer connected was $45.29. An estimate of the average additional cost to connect range customers where service is already supplied for lighting, is $35 per installation.

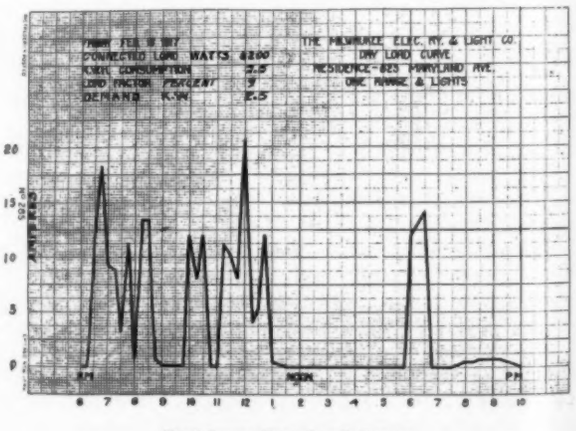
Service to Range Customers.

No plan for taking on an electric cooking load will be complete without a brief consideration of the question of service after the range is sold. In the olden days of less reliable equipment, the customer who had been obliged to go without his light, was an extremely disagreeable person to handle. The utility has no desire to see the same customer, today, when he has been obliged to go without his breakfast. Fortunately, cooking equipment is sufficiently reliable and the utility's range service can be made sufficiently complete, to reduce the element of trouble to a negligible minimum. All that is necessary is to see and appreciate the facts.

The electric range is new in the field of electric service-using devices and the service rendered by it must gain the confidence of the people, before it will be geenrally adopted. It is unfortunately true of many utilities that they do not realize the important part that service plays in establishing the electric range in the good graces of the service-using public. It is also true that the sales departments of these same companies have been lax in not impressing the necessity of attention to this particular feature, on the minds of their operating department heads.

Analyzing the service which must be rendered by the operating departments in detail, we bring out the following. The individual electric range has a relatively high demand, as compared with the usual household appliances. Its installation must receive the same engineering attention that any installation of industrial power receives from the distribution engineers. By this, is meant that the circuits, transformers, and all connections to the terminals of the range should be carefully designed, selected, and installed in order that there may be the proper voltage, and freedom from outage that would characterize the service to the biggest power job on the lines. This matter being properly taken care of in the first place before the range is ever used, will eliminate much trouble and is considered the first step in rendering good service to cooking customers.

The next step to be taken immediately after the range has been reported as properly installed, inspected and tested by the man in charge of range installation, is to arrange with the customer for an early demonstration by the department of the company responsible for such work. The demonstrator, whether male or female, preferably the latter, should be selected after a very careful examination as to her ability to demonstrate an electric range. Of equal importance is her ability to understand the many different dispositions which are to be encountered in the day's work in such an employment as range demonstrator. Her ability to gain the confidence of the people before whom she is demonstrating, will do much more to win over a prejudiced housekeeper or servant than the demonstrator's skill as an electric range operator or her knowledge of cooking. A continuance of the assistance and advice of the demonstrator after the range has been installed, and until such time as the customer is perfectly satisfied with the range and is able to produce results unaided, is an inseparable part of good service.



Residence Day Load Curve.

The experience in Milwaukee indicates that the peak load of range customers living in residences occurs at noon while for customers living in apartments it occurs in the evening.

The third step in the matter of good service is a periodic call by the salesman who negotiated the purchase in order to have the customer feel that an interest is being taken in his purchase after the sale has been made.

TABLE I.—RECORD OF KILOWATT-HOURS USED FOR COOKING BY 20 CUSTOMERS.

CUSTOMER NO.	NO. OF PERSONS IN HOUSEHOLD	1ST	2ND	3RD.	4TH	5TH	6TH	7TH.	8TH	9TH	AVERAGE K.W.H. PER MONTH	AVERAGE K.W.H. PER PERSON PER DAY.
1	4	112	98	102	193	145	149	159	122	136	135	1.12
2	4	136	141	134	136	131	106	110	110	125	125	1.04
3	4	80	78	86	83	111	114	89	114	84	93	.77
4	3	144	122	132	129	142	199	136	107	142	139	1.54
5	2	79	60	45	64	66	53	41	74	95	64	1.07
6	4	57	64	72	82	88	97	77	98	128	85	.71
7	4	220	186	70	112	120	98	77	134	143	129	1.07
8	4	74	83	101	134	154	123	128	176	166	127	1.06
9	5	190	158	141	171	178	223	217	253	—	190	1.27
10	5	55	64	65	81	76	105	88	112	78	80	.53
11	5	120	194	149	162	143	130	219	121	69	145	.97
12	8	202	315	312	274	—	—	146	268	244	252	1.05
13	2	53	42	51	24	41	72	54	59	58	50	.83
14	7	119	135	159	213	132	142	122	96	150	141	.67
15	3	137	131	148	134	136	132	132	119	150	135	1.50
16	3	91	83	42	54	21	73	72	64	80	64	.71
17	2	39	154	141	178	164	116	31	30	34	99	1.65
18	3	130	157	175	148	148	295	167	131	—	169	1.88
19	2	64	65	73	47	—	74	116	118	103	83	1.38
20	4	206	29	43	151	155	125	98	159	119	121	1.01
										WEIGHTED AVERAGE	119.44	1.03

TABLE II.—CONSUMPTION BY RANGE CUSTOMERS IN A MILWAUKEE APARTMENT BUILDING.

APARTMENT	NUMBER	CONNECTED	FEBRUARY		DAILY	KILOWATT HOURS		CONSUMPTION					TOTAL	No.	JANUARY
No.	ACTIVE	LOAD	7	8	9	10	11	12	13	14	15	16	K.W.H	OF	1917
	ROOMS	WATTS	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	PER CUSTOMER	PEOPLE	K.W.H.
1	3	800	.3	.2	.5	.1	.6	.4	.0	.8	.0	.8	4.2	2	15
103	1	.400	1	2	1.6	4.3	2.3	1	1.5	2.5	1.	1.2	18.4	2	51
107	2	3.700	1	.5	1.4	1.2	1.7	.8	1.7	.7	.8	.5	10.5	2	47
108	2	3400	2.1	2.8	1.2	1.9	2.6	.7	5.9	2.6	1.8	1.7	23.4	2	62
110	3	5300	4.4	3.9	1.7	4.2	5.5	2.3	1.3	3.8	3	3	33.1	3	97
112	1	5400	2.7	2	3	1.5	3.5	1.3	8.5	21	5.4	5	34.8	2	169
111	3	5300	6.7	4.2	5.9	6.4	5.3	8.4	.3	5.5	6.3	9.4	58.4	4	
203	2	300	.6	.3	.6	.1	.6	.3	3	.7	.5	.3	6.9	1	15
205	2	4300	2.9	2.8	3	5.7	2.7	4.9	3	3.7	2.	4.2	34.9	3	
206	2	4800	2.7	2.5	3.8	3.8	4.7	4.3	6.7	2.1	3	2.4	39.0	3	126
207	2	3800	0	0	0	0	0	.3	0	0	0	0	.3	1	71
208	2	3700	2.2	3.4	3.7	2	2.3	.3	1	2.5	3.5	2	18.9	2	78
209	2	3900	3.3	3.4	3.6	6.4	4.3	1.3	2.9	2.6	3.2	2.2	33.2	3	150
301	1	150	0	0	0	.4	.3	.2	1	.4	.0	.5	1.9	1	14
303	1	100	.4	.1	.1	.7	.4	.2	.4	.3	.4	.8	3.8	2	7
212	2	4800	3.3	3.2	5.1	10	4.2	3.2	4	7.9	8	6.9	50.4	4	
306	2	5100	0	0	0	0	0	0	0	0	0	0	0	2	9
307	2	3600	2.5	2.5	5.3	2.4	4.5	1.1	3.7	3	2.3	4	31.3	2	46
308	2	5100	4.2	4	1.3	2.3	1.4	1.5	1.5	1.5	1	1.8	15.5	2	
309	2	3400	3.3	4.3	2.7	2	.6	4.7	.5	3	3.7	4	18.5	3	
312	2	4500	2.5	2.8	4	1.7	.5	2.3	3	4.3	3.5	3.2	23.1	2	32
401	2	160	.5	0	.6	.5	1	0	.4	.6	.3	.5	3.4	1	8
403	1	150	0	.2	.2	.2	.3	.5	0	.1	.0	.2	1.7	1	7
405	3	4300	3.2	2.7	3	3.6	2.2	2	2.9	1.3	2.2	4.6	22.7	2	
406	2	5105	2.5	2.8	6.7	3.7	2.7	1.6	2.9	7.2	6.5	5.3	41.9	3	114
407	2	3395	2.1	.8	.5	1	2.3	.8	.4	1.3	1.3	1.2	11.7	2	101
408	2	3590	0	1.3	1.1	.9	1	0	0	.0	3.2	2.5	10.0	1	25
409	2	5590	2.7	2.3	3.5	2.1	5.2	4	5	4	4.2	2.2	35.2	3	159
412	2	4500	0	0	.1	.2	2.3	3.1	4.7	7.2	6.5	5.3	29.4	2	182
TOTAL		97140	52.8	49.3	60.5	64.2	68.4	54.5	64.9	73.7	73.6	76.7	739.6		
MAXIMUM DEMANDS			16.8	21.4	22.8	13.2	7.2	16.8	15.6	18.7	17.9	19.2			
LOAD FACTOR PERCENT			13.	9.6	12.	20.3	38.5	17.	13.5	16.	17.1	16.7			

Electric Power for Operating Bridges

An Article Illustrating the Dependability of Electricity for the Operation of a Group of Five Trunk-Line Railway Bridges, All Using Central-Station Service—Decriptions of Electrical Installations and Methods of Operation

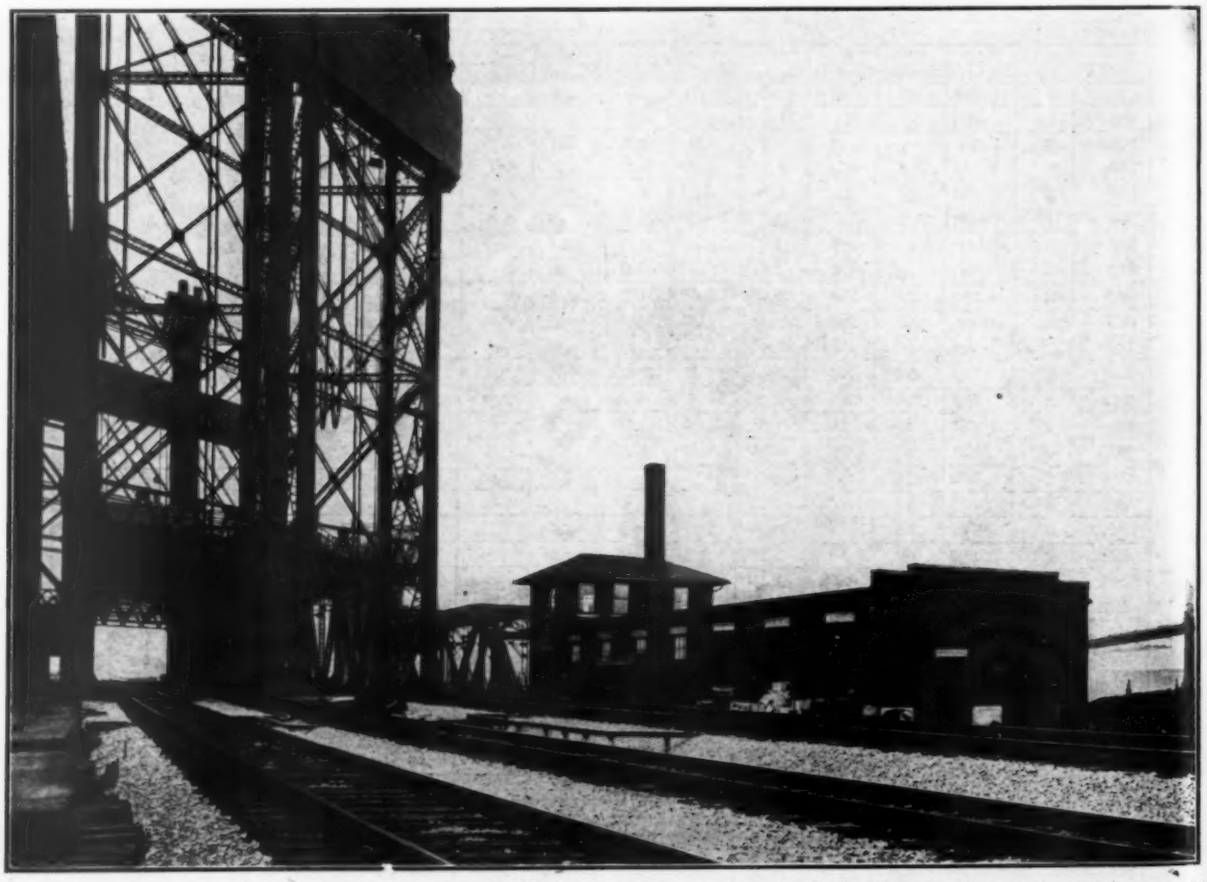
Industrial Power Series—Article No. 195

ONE of the chief advantages of the use of electricity that recommends it to power consumers is its dependability from an operation standpoint. Working to this end is the fact that a number of sources can be created for the supply of electrical energy to the point of operation, thus assuring continuity of service, which, in some instances, is not only desirable, but absolutely essential.

This dependability of service is one of the best arguments the electric power salesman has—one that makes a direct and tangible appeal to anyone contemplating the use of electricity for power. Interruptions due to lack of power have often been the experience of manufacturers and other operators and power service that will prevent such occurrences is appreciated and finds ready recommendation. That many central stations can point, with justifiable pride, to records showing long periods of uninterrupted service on their lines is one of the important reasons for the rapid increase in the use of electricity for power purposes.

A very good illustration of this point is given in the operation of a group of five railway bridges over the Calumet River in South Chicago, Ill. These bridges are installed on lines of the Lake Shore & Michigan Southern Railroad, Pennsylvania Lines and Baltimore & Ohio Railroad, and are a part of the trunk lines of these railroads between Chicago and eastern points. Because of the large amount of traffic that passes over these structures it is imperative, to assure safety and to prevent delays, that the methods of operation be the most satisfactory obtainable and that they be subject to a minimum number of interruptions.

Electric power was chosen by each of the railway companies for the operation of the bridges, and all are operated on central-station service, supplied by the Commonwealth Edison Company, of Chicago. It is interesting to note the attitude taken by the different companies regarding the dependability of central-station service. Two of the bridges have only one method of operation, dependence being placed on a storage-battery station charged by central-station power. One of the bridges is operated directly from the central-station company's lines, with a gasoline engine for emergency use. The remaining two bridges can be operated directly from central-station service through a motor-generator set; from a generator driven by a gas engine, and from a storage battery which can be charged from either source. Energy for the operation of all the bridges is supplied from the Commonwealth Edison Company's substation in South Chicago, about three blocks distant from the bridges. A pole line carrying 4,400-volt, three-phase, 60-cycle circuits runs from the sub-

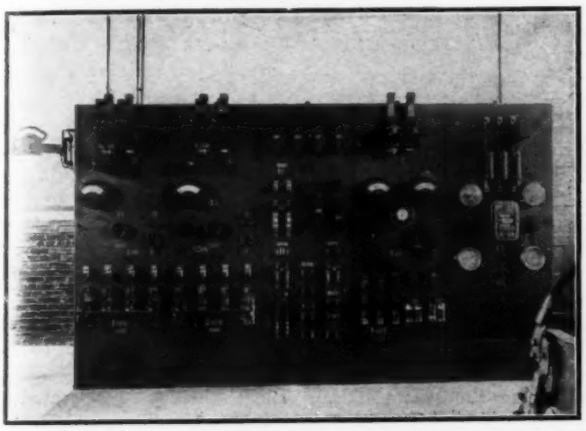


General View of the Lake Shore & Michigan Southern Lift Bridges and Power House in South Chicago—Part of the Baltimore & Ohio Bascule Bridge Can Be Seen in the Center of the Illustration—The Pennsylvania Bridges (Not Shown) Are to the Left of the Lake Shore Bridges.

station to the west bank of the river. The substation is fed from the company's main distribution system by means of three different underground feeder circuits, which is an important factor in making the service dependable.

Baltimore & Ohio Bascule Bridge.

The Baltimore & Ohio bridge is a Strauss bascule bridge of the cantilever type. The span is 246 feet, making it the largest one-span bridge of this type in the world. The power service lines run to a transformer vault on the west bank of the river, from which side the bridge is operated. Three transformers, each of 100-kilowatt capacity, step the voltage down to 440 volts, which is the operating voltage. In order to raise the cantilever span an exact order of closing switches must be followed, an interlocking system preventing the supply of energy to the motors and guarding against carelessness and lack of operation knowledge. After the switches controlling the front and tail rail-locks have been closed, a bridge-lock switch is closed, releasing the structure for raising, and operating an automatic circuit-closer which connects the two bridge motors to the line. These are wound-rotor induction motors, both of 140-horsepower capacity, the speed being governed by drum-type controllers. The general practice is to use both of the motors in operating the



Switchboard in Lake Shore & Michigan Southern Substation and Power Plant.

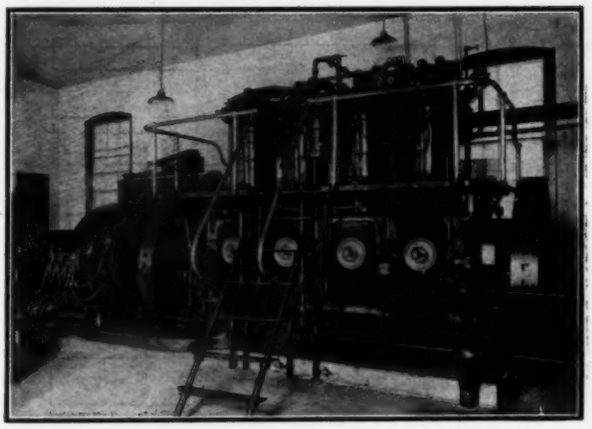
bridge, so as not to throw a large load on either when starting. Each motor, however, has sufficient capacity to operate the bridge alone, assuring satisfactory operation if one of the motors should be placed out of commission. If both motors are disabled or if the electric power service fails, a 35-horsepower gasoline engine, provided for emergencies, is used for bridge operation. It is connected with the chain of drive gears by means of a sliding gear, and when this is shifted to connect the gasoline engine the motors are automatically disconnected.

During the summer months, when navigation is at its height, the bridge is raised and lowered on an average of about 30 times daily, while during the navigable winter months this average is reduced to four or five. It takes about 1.5 minutes to raise and lower the bridge.

Lake Shore & Michigan Southern Bridges.

A short distance south of the Baltimore & Ohio bridge are two bridges belonging to the Lake Shore & Michigan Southern Railway. There are both two-track structures of the Waddell & Harrington vertical-lift type. The span of each lift is 206 feet and the weight of each lift-span is about 900 tons.

The electrical installation for the operation of these bridges is more elaborate than that installed by either of the other railway companies on their bridges. Three sources for the supply of electric power are available.



Gasoline Engine Driven Generating Unit in Lake Shore & Michigan Southern Power Plant.

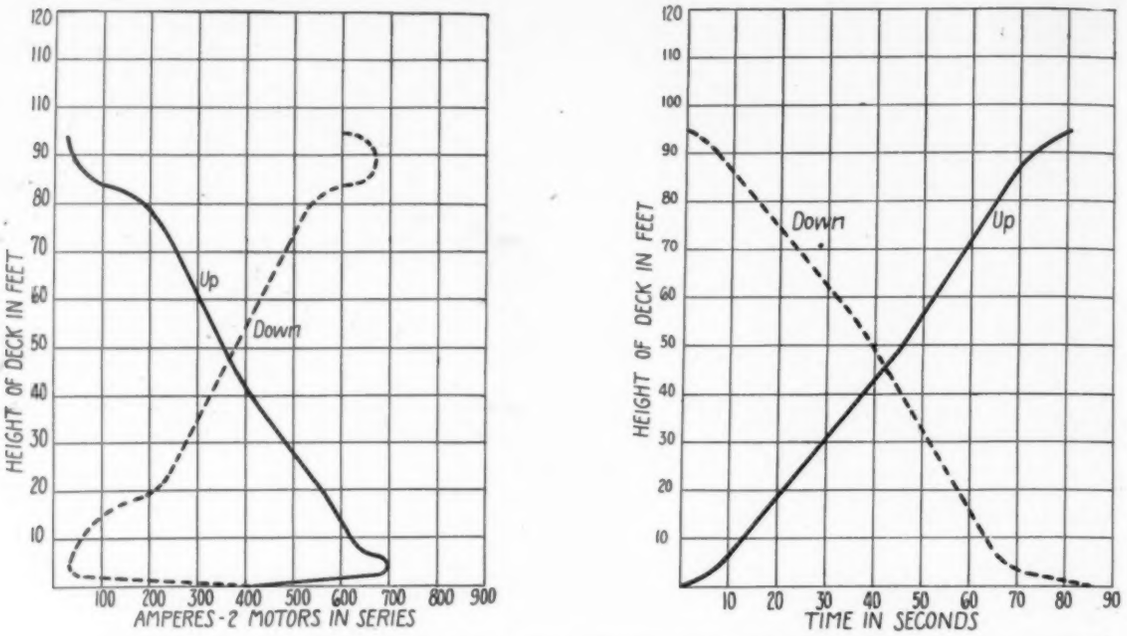
These consist of central-station service connected to a motor-generator set, from which the bridge may be operated directly; a gasoline engine direct-connected to a generator, which will supply energy for bridge operation, and a storage-battery system, which may be charged from either generator, and which is generally used for supplying the energy for operating the bridge. These interconnected systems are independent of each other except in the extreme case when the batteries are discharged, and they furnish nearly perfect protection against failure of energy supply.

Taps are made from the central-station company's 4,400-volt, three-phase, 60-cycle lines on the west bank of the river and a circuit run through a three-inch iron pipe in a tunnel underneath the river to the transformer vault on the east bank, where the power plant is also located. From the transformers the 440-volt secondary circuit goes to the main switchboard connecting to the meters and to the control switch of a 175-horsepower induction motor direct-connected to a 220-volt direct-current generator. Switchboard equipment is provided for supplying the output of this generator to charge the storage batteries or directly to the bridge motors.

The gasoline-engine unit consists of a 200-horsepower four-cylinder Bruce-Macbeth engine direct-connected to a 175-horsepower generator similar to the one forming part of the motor-generator set, and which also has switchboard equipment for supplying power to the batteries or to the bridge motors direct. Apparatus is also provided for running the generator as a motor from the storage-battery for starting the engine.

The motor-generator set is used the most frequently for charging the storage-battery system, consisting of 117 cells, which have a total capacity of 2,600 ampere-hours. Most

Hoisting Equipment Tower on Lake Shore Lift Bridge, Showing Motors and Controller Resistance Units.



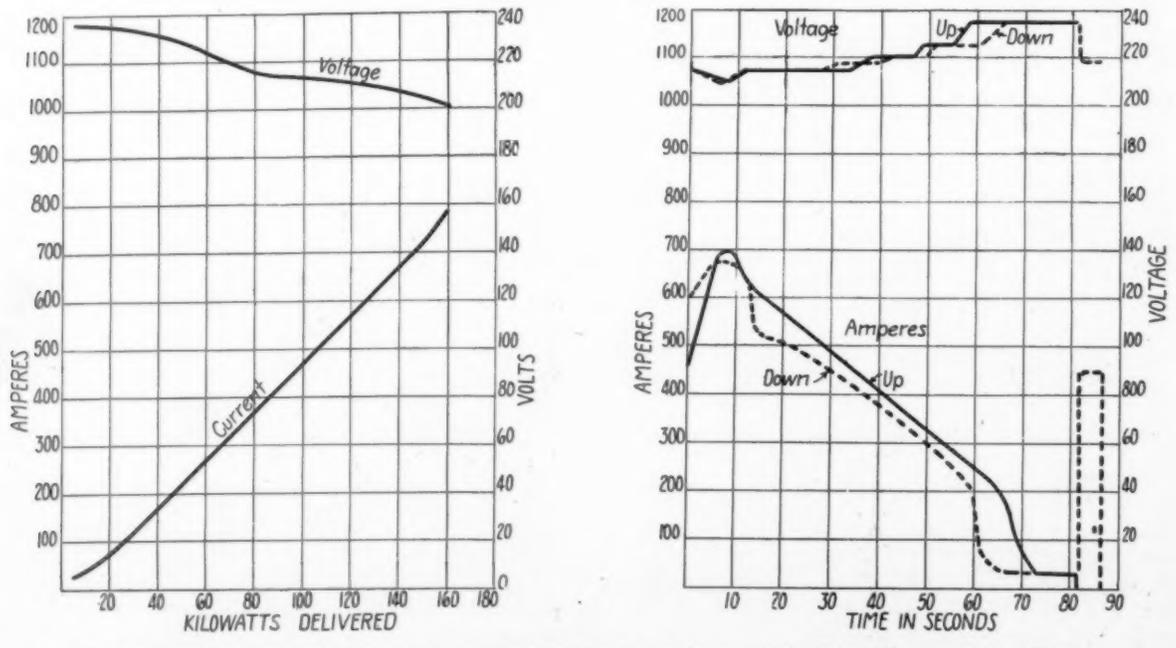
Curves Showing Current Consumption and Time for Raising and Lowering of Span of Lift Bridge.

of these cells are used for bridge operation, though some eight or ten of them are switched off to provide energy for signaling equipment.

Each bridge is operated by two 100-horsepower, mill-type series motors which drive gear trains connected to drums for winding or unwinding the cables which hoist and lower the lift span. On lowering, the motors drive through a load brake in a manner similar to that on the hoist of an electric crane. The lift span is supported on the four corners by cables and sheaves suspended from the end towers and the weight of the span is kept uniform by means of heavy equalizer chains (shown in an accompanying illustration) attached to the towers and the lift span. The motors of both bridges are operated by control apparatus located in a stationary tower between the two bridges. The control is semi-automatic, consisting of two three-point hand controllers with relay-operated switches for cutting in and out the grid resistances in the supply circuit.

The most efficient precautionary methods are provided for the safe operation of the bridges, and they could not be operated or non-operated so as to plunge a train into the river. Bridge and rail-lock switches must first be operated before energy can be supplied to the motors. To further guard against accidents, the electrical system is arranged so that a bridge cannot be unlocked for raising until the signals are operated to show the engineer of an approaching train that the bridge is up. Derails are also placed in service to provide against failure to act on signals.

During the summer months each bridge is operated 20 to 25 times a day. They may be raised a maximum of 98 feet in about 45 seconds, with a power consumption of about five kilowatt-hours. When navigation is open the



Curves Showing Power Relations and Current and Voltage for Raising and Lowering of Span of Lift Bridge.

total energy used per sonth for charging the batteries for bridge and signal operation approximates 7,000 kilowatt-hours, with a maximum demand of 140 kilowatts. The storage-battery system permits the use of service during off-peak periods, making the load desirable from a central-station standpoint and at a price attractive to the consumer.

Pennsylvania Bridges.

Situated adjacent to the Lake Shore bridges are two belonging to the Pennsylvania Lines, and they are both two-track structures of the same type as the former bridges. Each lift span is 210 feet from center to center of end pins, and the total weight of each is about 950 tons. The method of operation of the lift spans is also similar, except that the operator's tower and control equipment is a part of each lift span and travels with it.

Central-station service is supplied to two motor-generator sets, each consisting of a 35-horsepower induction motor connected to a 220-volt direct-current generator. Ordinarily one of these sets is used for charging a storage-battery system, the other set being provided for emergencies. This equipment, together with switchboard, etc., is installed in a concrete cellar underneath the company's tracks on the west bank of the river. The storage-battery equipment is depended upon entirely for the operation of the bridges, and has given satisfactory and uninterrupted service. The power consumption, which is off-peak, is about 5,000 kilowatt-hours a month for 20 to 25 lifts a day.

The accompanying diagrams show the operation characteristics of the electrical equipment of a lift bridge of the type described.

Large Power Project Planned by Connecticut Companies.

By the terms of a bill that is now before the Connecticut Assembly, the Housatonic Power Company, one of the subsidiaries of the New Haven Railroad Company, is empowered to sell its rights and properties to the Rocky River Power Company, whereupon a new corporation, the Connecticut Light & Power Company, will develop and operate the same.

The Housatonic Power Company operates a hydroelectric plant on that river and a large steam plant at Waterbury. The company now generates and sells electricity to the Connecticut Company, a traction system, and to the public in New Britain, Waterbury and other places, through the local electric light companies.

The Rocky River Company owns five valuable water powers on the Housatonic and its tributaries.

One of the advantages of the merger will be the coordinated use of the river flowage as between the several stations. More energy will be obtainable than heretofore by harmonious working. The ultimate developed horsepower will be about 50,000, and an auxiliary steam plant is likely to be built to provide for the seasons when the flowage is inadequate. It is said that negotiations have been entered to furnish the New Haven railroad with its entire electrical supply.

Indiana Tornado Damages Electric Plant.

Electric-lighting service in New Albany, Ind., was disorganized on March 23 by the tornado which damaged a portion of the city. Wires were blown down by the high winds which affected the whole city, and for safety's sake there was no attempt made to provide service even to those parts of the city where the system was comparatively intact. Crews of the United Gas & Electric Company, with assistance from Louisville, put in the following day restoring service and cutting wires at the entrance of the devastated area so as to obviate chance of damage from grounded wires.

Maine Bills Seek Public Control of Water Powers.

Two bills are before the Maine Legislature which aim to conserve the water powers of the state. One bill, introduced by Representative Dutton of Bingham, creates a commission of three which, on authorization of the governor and council, may take over by purchase or eminent domain, all lands, works, dams, buildings, flowage rights, plants, machinery, transmission and distributing lines. This commission would have authority to develop the power and sell to municipalities, who would distribute the energy. The commission is given sole right to regulate all charges and rates.

The other, or Baxter bill, creates a commission to study the state's topography, and report to the next Legislature, if possible, a plan for the improvement and creation of storage reservoirs, reporting on rights remaining in the state to be developed and the best methods for development. The commission would have supervision over the construction of dams by private companies.

At a session last week P. B. Yates, formerly of the Hydroelectric Power Commission of the Province of Ontario, told of the accomplishments of that commission, and the beneficent results accruing to the province.

It appeared that the Dutton bill is a copy of the legislative act under which the Ontario Commission was created.

Edward F. Merrill, of Skowhegan, argued that the Ontario Parliament, unhindered by a written constitution, had conferred absolute powers on the Commission. The State of Maine could not do this, any commission's power being sharply limited by the state and federal constitutions.

Mr. Yates said the Commission charged $18 per horsepower for all power exported and $12 for that used in the province or Dominion. Recently the policy has been to restrict the sale of power outside the Dominion. He said the Commission paid adequately for all property taken. Sales of municipalities are at the average price of 3.9 cents, ranging from 11.5 to 2.4 cents per kilowatt-hour.

Opponents of the Dutton bill pointed out that the courts of Maine have ruled that private property cannot be taken by right of eminent domain except for public uses, and that the sale of electricity for power is not for public purposes. The constitution would prevent confiscation.

Safety Rules for Electrical Installations in Mines Issued.

The Bureau of Mines, Department of the Interior, has just published Technical Paper 138, "Suggested Safety Rules for Installing and Using Electrical Equipment in Bituminous Coal Mines," by H. H. Clark and C. M. Means. The preparation of this code of rules, which has been going on for nearly three years, was undertaken to encourage the standardization of safety measures for the prevention of electrical accidents underground.

The code is the result of many conferences held by the authors with mining engineers, mine operators, the engineers of public service companies, and the manufacturers of electrical mining equipment. The rules have been revised many times at the suggestion of the conferees, and, as published, are said to meet with their approbation in almost every detail.

Mr. Clark, in discussing the paper, says: "The code is unique in some respects. The first step in its development was to establish five basic measures that would insure the use of electricity with safety and to use these as a basis upon which to formulate the rules. Each rule is proposed as necessary or helpful to the accomplishment of one or more of these measures. Their general enforcement will work toward preventing many casualties."

Electrical Opportunities in the Navy

Secretary Daniels Calls for About 25,000 Recruits of Whom a Considerable Number Must Be Trained in Electrical Work

PRESIDENT WILSON has issued orders for the recruiting of the United States Navy to its authorized war strength of 87,000 men, which will require the immediate enlistment of about 25,000 recruits. Should the present national emergency develop into actual warfare, a much larger number of men will probably be required. In the latter case, the naval reserves and re-enlistments will furnish many of the men needed, but the Navy will require enlistment of large numbers of men who have never seen naval service and will therefore require more or less preliminary training. Naturally, preference will be given to men with some experience in seamanship or the nearly 30 other trades represented in the Navy in order to diminish the time for the special training that recruits need to fit them for the special duties of navy service.

Naval service offers many inducements to ambitious and spirited young men. Not only does it provide opportunities for free travel in many nearby and distant waters with changing scenes, but it furnishes excellent training of high value in civil pursuits at the conclusion of enlistment. It also furnishes steady, healthful work, free board of a wholesome nature, free lodging and clothing, and in addition provides pay, even during the period of training, that can be practically all set aside for saving. The United States Navy pays its enlisted men better than any other national navy and in most lines more than the men could save and in some cases even more than they would receive in similar pursuits in civil life. Above all this it enables the men to render the highest patriotic service open to the citizens of any nation, that of defending the security of their country in the first line of defense.

The many uses of electricity aboard ship and in the naval stations have been steadily increasing. It is used not only for lighting and power service, but also for communication and signaling, and even for cooking and baking. There are a multitude of electric motors in use for ventilating blowers, ammunition hoists and conveyors, gun-pointing equipments, turret-turning machinery, and various other purposes. These motors are supplied through special control apparatus from turbogenerators, engine-driven dynamos, motor-generators, etc. The lighting equipment includes incandescent and arc lamps, searchlights of the highest powers, special signal lamps, etc. Communication apparatus consists chiefly of telephones and radiotelegraphic sets. Machinery and apparatus in use in the Navy are of the highest types, consequently the training and experience received in their operation and maintenance are of exceptional value to the electrician or radio operator in after life.

Since the proper operation and care of all the varied electrical apparatus is essential to the efficiency of the Navy, it is the practice to send all new recruits for this branch of the service to either of the two Navy Electrical Schools at the navy yards at Brooklyn, N. Y., and Mare Island (San Francisco), Cal. These schools provide instruction in two classes, general electrical work and radiotelegraphy. The length of the full course for both classes is eight months. Men specially proficient in the work pass through this period in shorter time, depending on the knowledge and skill they show. All students, either recruits or men from the general service, may enter these schools at any time. In addition to the practical instruction imparted at the electrical and other naval trade schools and training stations, the men receive throughout their service aboard ship and elsewhere both academic and practical training to enable them to demonstrate their ability and to advance.

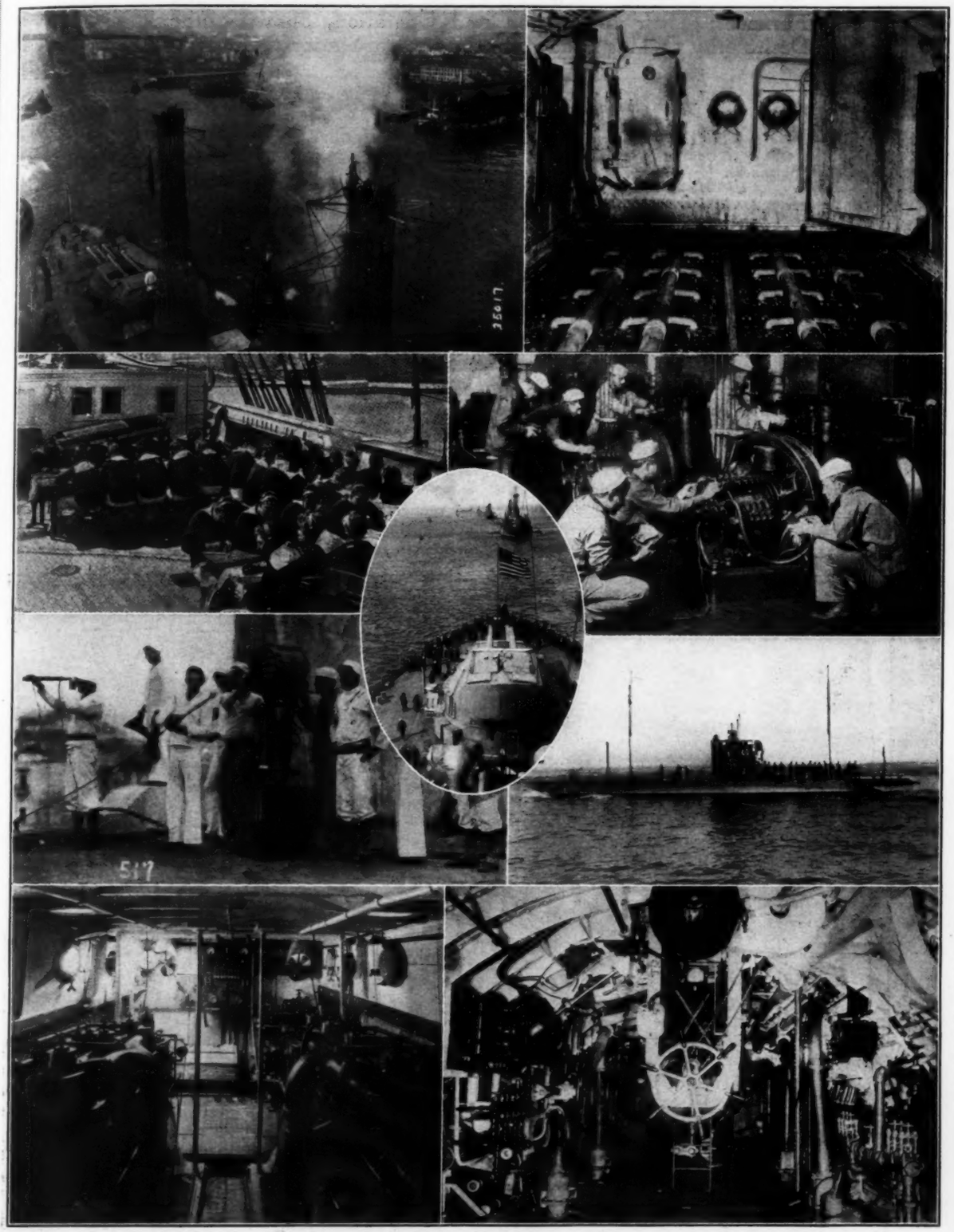
In order that a recruit may enlist for the electrical branch, he must have a knowledge of either general electricity, or be an operator of the Morse telegraph code or have sufficient foundation in radiotelegraphy to be competent to keep up with the class at the school. Electricians (general) must know the names and uses of the various parts of the dynamo and dynamo-driving engines and must be familiar with the ordinary types of switchboards and methods of wiring. Applicants for both classes must be able to write legibly, must understand elementary arithmetic and must be between the ages of 18 and 25. All applicants must be citizens of the United States, either native or fully naturalized. Applicants for the radio branch must, in addition, pass a creditable examination in spelling and penmanship and in arithmetic to include proportion, percentage and square root. Testimonials as to good character and skill as an operator must be presented by the candidate, either from former employers or from the principal of a trade school where the candidate has been a student in either telegraphy or radiotelegraphy. He must be able to receive 20 words per minute.

Recruits meeting these requirements are immediately transferred to the electrical school, where the course of instruction comprises machine-shop work, reciprocating steam engines, steam turbines, internal-combustion engines, magnetism and electricity, dynamos, motors, motor-generators, alternating currents, interior communication, lighting, batteries, etc. Members of the radio class are trained in all the duties of a radio operator and are given constant practice in the use of all the apparatus employed in radio and especially in receiving and sending by the systems employed in the Navy.

Immediately on being accepted and enlisted, the recruit is put on the Navy pay roll at $17.60 per month during his period of training. He is given free transportation to one of the Navy Electrical Schools, on arrival at which he is provided with uniform, clothing, and other necessaries amounting in value about $60. On completion of the necessary training at the school, the apprentice is given a position as electrician, third class, with pay of $33 per month. The pay for the higher electrical positions, which are attainable through promotion only, is as follows: Electrician, second class, $44 per month; electrician, first class, $55; chief electrician, with acting appointment, $66; with permanent appointment, $77 per month. This pay is in addition to free board, lodging and clothing.

Enlistments in the Navy are for a period of four years. A man will not be advanced to chief electrician (with rank of chief petty officer), during his first enlistment, but he may be recommended for that position towards the completion of his first enlistment, with a view to advancement upon re-enlistment if any vacancy exists. Special inducements in the way of a bounty and increased pay are offered for re-enlistment within four months of completion of first and subsequent enlistments. Additional pay is offered for special duties, such as instructors, signal men, service on submarines, etc. Opportunities are also open for appointment to the United States Naval Academy at Annapolis, Md.; through recent enactment 100 enlisted men in the Navy may be selected for this appointment annually so as to receive the Academy's special training for advanced officers' commissions. Altogether the Navy offers to young men splendid opportunities for honorable service of recognized value not only to the nation, but to the enlisted man himself.

What the Navy Offers in the Way of an Electrical Training



Naval Scenes of an Electrical Interest.

These views give a partial idea of the important uses of electricity in the Navy. In their order from upper left corner they show the following: Crow's nests on conning towers of a battleship between which the radio antenna is strung. Storage-battery compartment of a submarine. Radio class at one of the Navy Electrical Schools. Dynamo class at another Navy Electrical School. Naval searchlight in use by marines. Atlantic fleet in review and keeping in communication by radio and other signals. Submarine with antenna between masts. Speedy submarine chaser, showing main switchboard. Main operating room of a submarine with much electrical control gear.

Possibilities of the Electric Furnace

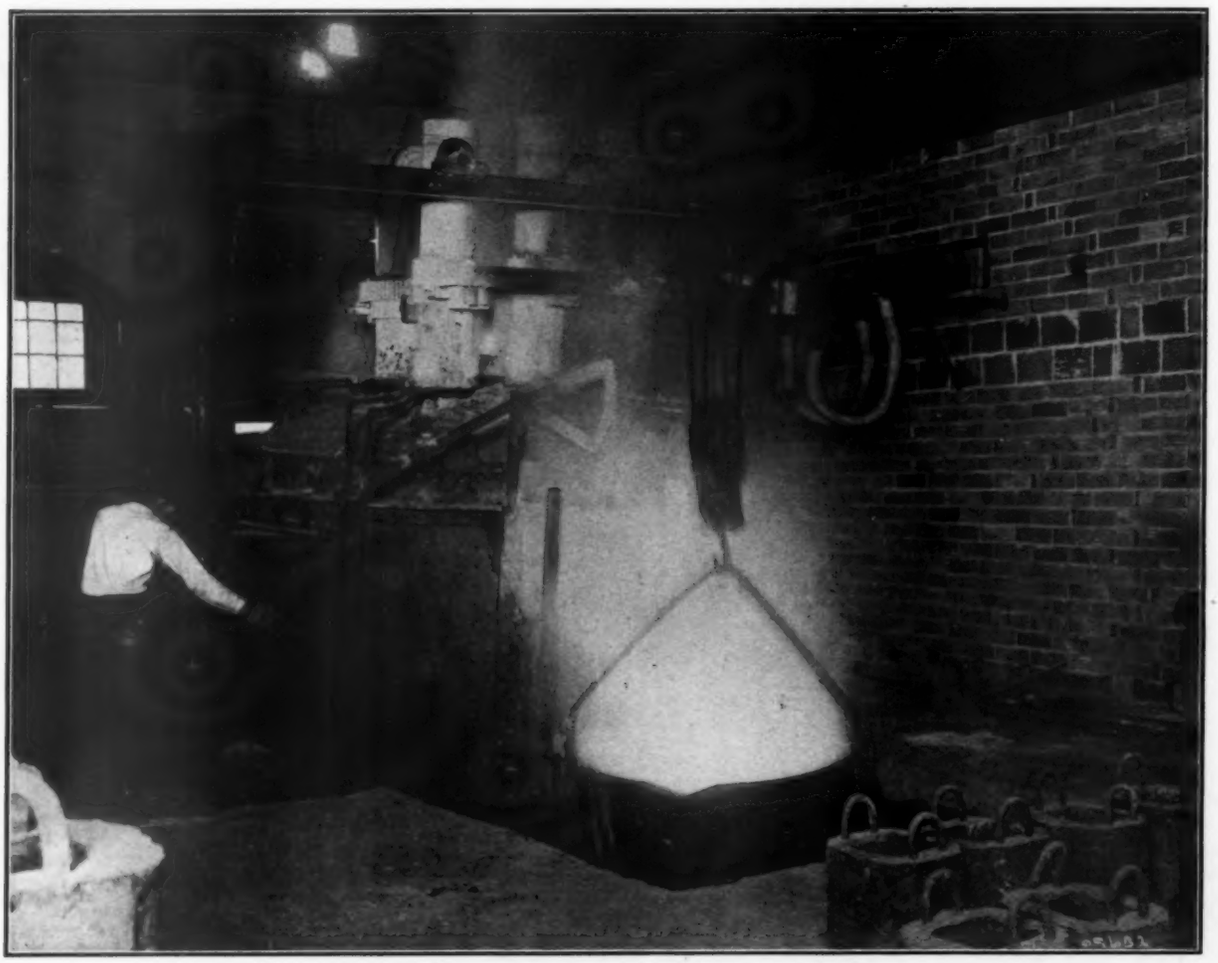
A Comprehensive Discussion of the Advantages of Electric Furnaces, Their Installation and Operation, Showing the Desirability of This Load from the Central-Station Standpoint

By THOMAS R. HAY
Duquesne Light Company, Pittsburgh

This is the first article of a series of two dealing with the electric furnace from the central-station standpoint. The second article, which will appear in an early issue, deals with the operating characteristics of furnaces and central-station rates for this class of business.

PROGRESS in chemistry and metallurgy has kept pace with the ever increasing demand for steel, but the instruments with which to apply this knowledge have not always been at hand. Various methods of heat production have followed each other in succession, but it is only in recent years that electricity as a practical source of heat generation has been seriously considered and applied. The beginning of the twentieth century was signalized by the advent of the electric furnace, and its introduction and practical development and use on an increasingly larger scale in the iron and steel industry. At first its application was made cautiously on account of the meager technical and metallurgical data available, and also on account of the comparative inexpensiveness of gas and coal as fuels. In recent years, however, in fact during a period signalized by the practical development and use of the electric furnace, the improvement in the generation and distribution of electricity has reduced the over-all differential between the costs of electric heat and heat produced direct from other fuels to such an extent that the electric-furnace engineers have been encouraged to continue development work on thermoelectric equipment, and iron and steel manufacturers have been encouraged to assist in this development on account of the fact that costs can be realized that are somewhat comparable with costs obtainable when using other cheaper forms of heat.

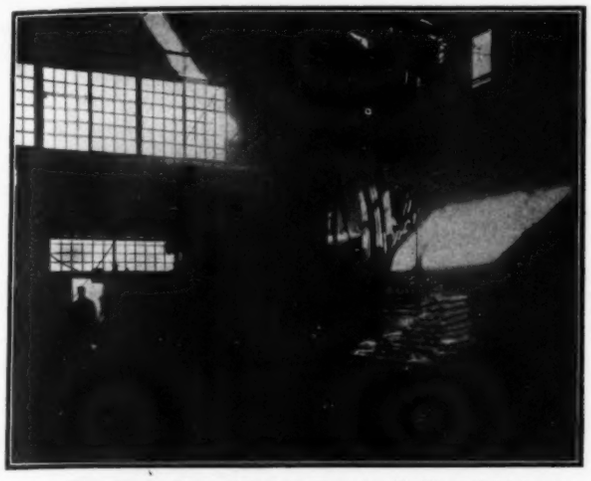
When, however, it is understood and recognized that by the use of heat free from contamination and from an oxidizing atmosphere, certain chemical reactions and metallurgical operations are made possible which cannot be performed by the older methods, and that not only can the dead melting operation of the crucible be duplicated, but cheaper materials containing objectionable ingredients can be refined and give a steel equal in every respect to the best quality of crucible steel known, then the really phenomenal growth of the electric furnace for use in the man-



A Five-ton Electric Melting and Refining Furnace in Action.

ufacture of the various grades of steel and its high-grade compounds can be understood.

Invention and research have produced two particular methods of applying electric heat to the steel melting and refining furnace. In the first case, there is the direct ap-



A Six-Ton Three-Phase Heroult Furnace Melting Cold Scrap.

plication of the heat from the electric arc to the charge in the furnace, and in the second case, the generation of heat in the metallic charge by means of induced currents. The first type is known as the arc type and can be operated satisfactorily on any standard frequency of current. The second furnace is known as the induction type and operates on low frequency circuits at 5 to 10 cycles. Of the two types mentioned the arc type is best adapted to general application, and for connection to central-station lines. The arc furnace is merely a brick inclosed hearth on which steel is made, the source of heat being the electric arc, just as heat from flame is utilized in furnaces using fuel; while the induction furnace is really an electrical apparatus, as it contains within itself the transformers which induce the heat in the charge.

With the usual arc-type furnace the electrodes are all suspended vertically over the bath, the current passing into and over the top of the bath in going from electrode. With a different arrangement part of the electrodes are suspended vertically above the bath, the hearth of the furnace or a specially designed electrode with holder acting to complete the circuit thus causing the current to pass into and through the bath. In addition to the two general types mentioned, which are applicable primarily to steel melting and refining, a third type, known as the resistance furnace, is used principally for heat treating, annealing, and for the melting of non-ferrous metals. It also operates satisfactorily at any standard frequency. The production of heat is accomplished by the passage of an electric current through a graphitic or other resistance, the heat generated being radiated to the roof and walls of the furnace and from there reflected on to the hearth. The temperature of the resistance furnace can be more easily moderated and controlled than can that in the arc-type furnace, and the reflection of the heat, although at a reduced thermal efficiency, acts to protect the charge from the direct application of the heat at temperatures that are too high, besides giving an equal distribution in a neutral atmosphere at practically constant temperature over the entire hearth, thus reducing metal losses by sealing and giving a more uniform heat throughout the charge. In non-ferreous melting furnaces of this type there is no burning out of metals and the furnace is hermetically sealed.

With but few exceptions, the power for operating these furnaces is purchased from the central station, whose power supply is universally polyphase at 25 or 60 cycles, with delivery at any voltage needed. In furnaces of small capacity, say up to one ton in capacity, single-phase service is permissible. In the large furnaces polyphase supply involving the use of more electrodes or current conductors is necessary, as it has been well established that as the capacity of the furnace is increased the number of electrodes should also be increased. There are certain very good reasons why any increase in arc voltage over that nominally used (100 volts) should be avoided.

Advantages of the Electric Furnace.

The principal advantages of the electric furnace over other methods of making steel are:

(1) It economically produces the highest temperature obtainable.

(2) It offers a ready and easy means of exact temperature control.

(3) Any temperature or treatment by slags is possible without contamination of the charge through gases and other impurities.

(4) Fusion is affected in a perfectly neutral atmosphere.

(5) More rapid steel melting can be accomplished with the electric furnace than with other types available.

Primarily the electric furnace is a refining medium and is not intended to and probably never will compete with the blast furnace for smelting iron ores, although with cheap fuel it has been and is being used to smelt highly refractory metals from the oxides. Without exception it is the best means of producing high-quality steel that is both fine and homogeneous.

The arc furnace may use either direct or alternating current, but for commercial reasons alternating current is almost exclusively employed, and for the same reason the use of three-phase current supply is becoming more general than that of single phase. Transmission voltage may be of any value, as it is transformed at the furnace to the voltage required for the melting or heating operation. As the arc is simply an electrical resistance, the working voltage at the furnace terminals depends on the length of arc desired. If the arc is to be confined between the bath and the end

Typical Transformer Installation Serving a Two-Ton Furnace.

of an electrode of considerable area, this arc should be as short as possible, so as to reduce heat radiation to the roof and walls and which is accomplished by the smothering action of the electrode while at the same time keeping the carbon electrode out of the molten bath. The usual voltage between electrodes is about 100, and this value may be varied about 10 per cent either way, depending on conditions and results desired. Separate transformers for each phase are preferable to a polyphase transformer, as trouble on one transformer in a polyphase connection would not mean a

complete shut-down, with consequent loss of all or a part of the charge in the furnace. Single-phase transformers for a polyphase installation, instead of one polyphase transformer, will mean a slightly more expensive installation. It is the usual practice for the transformers to be furnished as an integral part of the complete furnace installation, and this feature need not particularly concern the central station, except insofar as it may mean a complete outage with consequent loss of revenue.

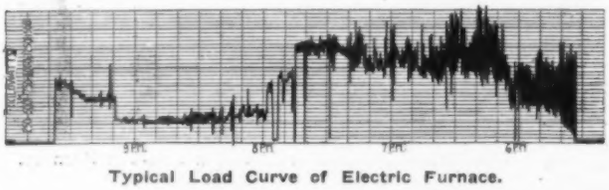
The Furnace as a Central-Station Load.

The electric furnace is a desirable load for the central station, because it takes a large number of kilowatt-hours at one point with long hours of usage at a comparatively high load-factor, requires little attention from the central station after the connection is once made and can be adjusted in its operation so as to be very largely off-peak load.

Some furnaces are undesirable because of the very wide and very rapid fluctuations in the load, unbalancing of low phases, power-factor and probable distortion of the current wave form. This makes it very difficult to handle on a small power system, where the total capacity of the system is only a few times the size of the furnace. For example, if a six-ton (1,000-kilowatt) furnace were to be carried from a single 2,000-kilowatt generator, it would probably disturb all other service which it was attempted to serve from the same machine. Similarly, when a furnace load is carried over a line of normal impedence drop, its rapid fluctuations in load may under some conditions, make the line unfit for other service. Where, however, the generating and transmitting system has several times the capacity of the load taken by the furnace, these fluctuations become entirely negligible.

The electric melting furnace is substantially a big polyphase arc with but small steadying resistance or reactance, other than that in the furnace transformers and is liable to be short-circuited at any moment during certain stages of melting. A complete heat will cover from two to eight hours, but the usual time is from three to five hours, depending on the character of the product and whether the metal is fed in a molten state or as unmelted scrap.

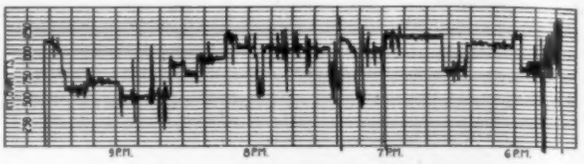
During the first half or three-quarters of an hour when melting cold scrap, short-circuits of varying magnitude and duration are likely to occur at any time until the charge is fully melted. Exclusive of short-circuits, the normal variation is something like 30 per cent, plus or minus the rating of the furnace during such period. At the end of the heat there may be a short peak of 10 to 20 minutes duration, due to the introduction of additional heat so that the charge may be in a highly fluid state before pouring. At times during the heat, the current may be reduced to a small value while introducing materials, such as limestone or other fluxes to change the metallurgical condition of the charge. On systems of relatively small capacity some ar-



Typical Load Curve of Electric Furnace.

rangement such as a closely set automatic cut-out, say a time-limit relay, and also artificial reactance, external to the furnace installation is desirable, as the load on short-circuit, with the resistance and reactance characteristics usually present on systems of relatively small capacity, may rise to from 10 to 15 times the full-load current.

On the larger systems it is often advisable to build a separate distribution circuit from the nearest main power feeder so as to be sure that the facilities are adequate to take care of the extreme conditions frequently occurring and so that other consumers may not be affected by outages or abnormal regulation of voltage and power-factor due to surges prevalent in the operation of the furnace when melting down. In the smaller systems it may often be advisable to build a separate line connecting with the station busses. On these smaller systems the connection of electric-furnace



Typical Load Curve of Electric Furnace.

load enables the use of larger and more efficient generating equipment and acts to raise the station load-factor, thus decreasing the cost of power at the station switchboard.

Standard Practice in Furnace Installations.

When making furnace installations it is generally advisable to locate the transformers as near the furnace itself as possible, so as to decrease the length of secondary leads to a minimum. If the furnace is in a pit the transformers may be set on a foundation on the floor, but if the furnace is not in a pit the transformers may be set on a concrete or brick platform. It is desirable that all equipment be as close together and as nearly self-contained as possible. A brick or concrete wall should separate the transformer and switching room from the electric furnace, so as to remove all operations from the vicinity of the incoming high-tension lines and so as to protect the transformers and switching equipment from splashing metal and from dirt and fine metallic dust. With the usual steel-making furnace the secondary leads from the transformer enter the furnace at the top for connection to the electrodes. When the leads come in to the furnace at the bottom they heat up the neighboring steel work due to high reactance, caused by the high currents. The distance between the secondary leads should be a minimum, so as to decrease the reactance. On account of the "skin" effect which appears in copper leads at high currents and which decreases the effective carrying capacity, the addition of more copper when the current exceeds 4,000 amperes in the secondary leads is not of much assistance, as the heat losses are not materially decreased and there is no appreciable increase in carrying capacity.

When the secondary leads are brought in at the top of the furnace the stiff copper cable busses (usually 2,000,000 circular mils) from the secondary terminals of the furnace transformers should be connected to the flexible leads to the furnace electrodes by means of a copper plate. The flexible leads should be of sufficient length to allow maximum movement of the electrodes which are raised and lowered in a vertical position, as it is desired to vary the current input to the furnace and as the electrodes wear shorter. When a brick or concrete wall is erected between the transformers and the furnace, square openings should be made in the wall at the proper height.

With the larger furnace installation it is usually advisable to purchase transformers with interlaced secondary leads. This arrangement will act to decrease the losses and the heating, by cutting down the inductive drop between the transformer secondaries and the electrodes. These interlaced leads save in the first cost of the installation by increasing the carrying capacity of the copper used. Exact determination of the proper copper sizes to use is also possible by the use of the ordinary formulas and rules usually applied. About 4,000 amperes is the limit for straight bus work. Above that point, and even lower interlaced leads should be used.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

Porch Lighting Featured at Hartford, Conn.

The Hartford (Conn.) Electric Light Company has developed an extensive porch and all-night-lighting load. An all-night-light transformer is installed in connection with the regular lamp socket, and the porch or hallway is thus kept adequately lighted at a cost of only about 10 cents per month, 300 hours' operation.

It is pointed out that this trivial expense is one of the best of burglary insurances, and in addition guides the caller to one's door in safety and comfort.

Other uses for this equipment are in the up-stairs hall, bath room and nursery.

Brooklyn Company Closes 125 Contracts in Three-Weeks' Store-Lighting Campaign.

The accompanying illustration shows a quarter-page newspaper advertisement, which the Edison Electric Illuminating Company, of Brooklyn, considers has all attributes of a good advertisement, and one which has been favorably commented on by expert advertising men.

During the month of March, the Brooklyn Edison Company has conducted a store-wiring campaign of the unit pictured.

The company offers to install this fixture complete with wiring, Holophane reflector and 100-watt type "C" lamp, ready to light, for the special price of $8.87—$1.87 down and $1 a month.

It must be admitted that this advertisement commands

That Fixture
Installed complete, ready to light with all the necessary wiring and service connections
$8.87
Seven Months to Pay
$1.87 Down $1.00 a Month
A store-wiring offer for March only to all storekeepers along our existing service lines
Write or Phone nearest Edison Office.
Edison Electric Illuminating Co. of Brooklyn
360 Pearl Street. Telephone 4000 Main (Connecting All Offices)

Newspaper Advertisement Used by Brooklyn Company.

attention, tells its story concisely and creates a desire to buy; but, the fact that inquiries and orders have followed in satisfactory numbers, finally determines its real value.

Due directly to this special wiring campaign, the company has closed contracts with over 125 small stores for approximately 400 units in less than three weeks. By April 1, it is expected that contracts for over 600 units, will have been closed.

In addition to this, the regular store-wiring business has been stimulated to such an extent, that the company has closed over 75 new contracts.

Survey Made of Louisville Company's Power Business.

An analysis of the power load served by the Louisville (Ky.) Gas & Electric Company is given below. It is interesting to note that the present load of 28,509 horsepower is an increase of 21.2 per cent in two years:

Number of Power Customers and Connected Load.

Number of Customers		Total Horsepower
298	Installations of 5 H. P. and less	1,334
311	Installations over 5 H. P. to 10 H. P., incl.	2,541
221	Installations over 10 H. P. to 25 H. P., incl.	3,800
97	Installations over 25 H. P. to 50 H. P., incl.	3,655
56	Installations over 50 H. P. to 100 H. P., incl.	4,104
44	Installations over 100 H. P. to 200 H. P., incl.	6,387
11	Installations over 200 H. P. to 300 H. P., incl.	2,554
6	Installations over 300 H. P. to 400 H. P., incl.	2,073
2	Installations over 400 H. P.	1,284

Miscellaneous Power Installations.

		Est. total Horsepower
130	Private vehicle-charging rectifiers	520
14	Rectifiers and M. G. sets for operating motion picture machines	62
7	Electric cooking apparatus	51
5	Rectifiers and M. G. sets in public garages	47
2	Electric welding machines	53
4	X-ray machines	17½
10	Miscellaneous equipment, including physicians' apparatus, service for motor testing purposes, etc.	26½
1,218		28,509

Co-Operative Power Campaign In Denver.

Electric power is growing in favor among manufacturers of Denver, Colo. This is shown in the fact that electrical installations in Denver factories has gained 10 per cent in one year's time. The consumption of energy for power purposes has gained approximately 30 per cent in the past year.

With a view toward furthering the cause of electric power in Denver factories the electric bureau of that city is arranging a program that will be made up of papers presented by various manufacturers in Denver setting forth the economies and advantages of electric drive in the manufacture of their particular product. The talks, illustrated with motion-pictures, will show clearly the process of manufacture, so as to be not only interesting, but instructive, and imbued with that broad spirit which permeates Colorado manufacturers—"If you've got a good thing, let your competitors know about it."

It is expected by the Denver Gas & Electric Light Company that electric power will show a bigger increase this coming year than it did in the past year.

Boom in House Wiring in Pontiac, Mich.

The Pontiac Light Company, a subsidiary of the Commonwealth Power Railway & Light Company, serving the city of Pontiac, Mich., reports that it looks for an increase of from 35 to 50 per cent in business this year. Extensive house-building is assigned as one of the principal causes of this increase.

Electric Cooking Campaign at Stockton.

An electric cooking and heating campaign which is being conducted in the rural districts by the Western States Gas & Electric Company at Stockton, Cal., during the present month has resulted in the sale of seven ranges, four water heaters and five room heaters, having a total connected load of 54 kilowatts. The work so far has been largely educational and it is anticipated that from now on the sale of electrical appliances will be greatly increased.

Public Urged to Secure Highest Efficiency in Lighting.

In a bulletin issued by the Sealer of Weights and Measures of Massachusetts, some valuable popular information is given to users of electricity on measures of economy, and reasons why electricity bills are sometimes high, with suggestions for reducing them.

The commissioner says that meters are generally blamed for bills that seem unduly high. In reality they are not to blame, but the cause is: (1) dark weather; (2) additional lamps installed, or units of increased size; (3) dim lamps in use; these should be replaced by new lamps, and tungstens should be installed instead of carbon lamps; (4) lamps left burning in closets, attics, etc.; (5) laundry irons, toasters or other appliances used more than usually; (6) defective wiring; (7) machinery that is not properly oiled, and (8) errors in meter reading.

Systematic Follow-up on Dead Services in Rockford.

Because of the fact that considerable revenue is lost by tenants living in wired houses who have failed to have service connected when they moved in, the Rockford (Ill.) Electric Company has inaugurated a comprehensive follow-up system intended to keep a careful check on such conditions.

Briefly, the system comprises the keeping of an accurate record of all disconnects and a periodic check to ascertain their status from month to month. A tag with tear-off coupon, as shown in the accompanying illustration, furnishes the means for the follow-up. As will be noted, each tag and coupon bears a serial number. The tag is attached to the meter and the coupon is filled in and detached. Space is provided for the date of disconnecting, the reason, and the name, address and nature of business of the old customer.

The coupons are sent to the new-business department where they are filed in numerical order. This file represents potentially a large amount of new business and one man has been delegated to give his entire time to a systematic follow-up so that each installation is visited or information concerning it obtained once each month.

Size and Characteristics of Motors for Rock-Crushing Plants.

By C. E. Brainard.

Because of extreme operating conditions, inherent in rock-crushing plants, stone quarries, cement mills, gypsum mills, fertilizer plants, ore mills, etc., considerable importance attaches to the proper selection of motors for electric drive, if the best results are to be obtained.

There are two general types of the induction motor which fulfill the usual requirements of rock-crushing plants, viz.: the slip-ring and the squirrel-cage types. The former, when furnished with drum-type non-reversible controller and resistance, is suitable for service requiring frequent starting under load, or the starting of loads with high inertia. This motor has a phase-wound rotor and external resistance connected through slip-rings and it is due to this feature that it will start with a high torque and a comparatively small amount of current from the line. The resistance is gradually cut out as the motor comes up to speed, until short-circuited. When the motor reaches full speed the rotor resistance will be almost as low as that of the squirrel-cage type motor and consequently good operating characteristics will obtain.

The squirrel-cage type motor, equipped with compensator is extremely simple and built to stand hard service. The absence of commutator enables it to operate satisfactorily in locations where dust and dirt would prevent the employment of the slip-ring type; but its construction does not enable this type of motor to be started with very high torque, consequently it is not adapted to certain loads, as for example ball mills, tube mills, etc. These mills require from 50 to 80 per cent more power to start than is required for their normal operation.

Broadly speaking there are three conditions to be met with in rock-crushing and metallurgical plants, viz.:

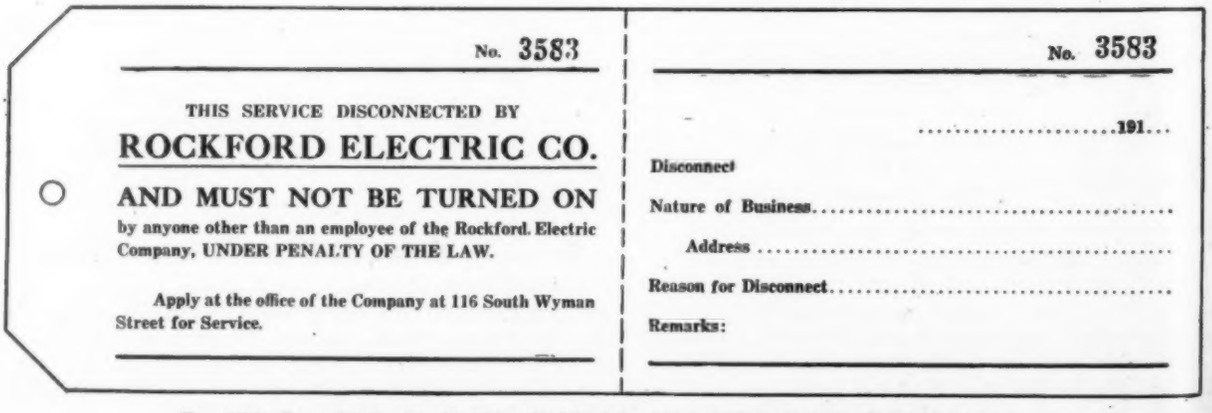
(1) Complete installation containing no units which require abnormal starting torque.

(2) Installation which includes one or more elements requiring large starting torque but for uniformity in operation should be driven by a single motor.

(3) Installations similar to (2) but which will permit of the different units being started or stopped independently.

It is obvious that the squirrel-cage type motor should be specified in the first instance; slip-ring type in the second, and a combination of both types in the third.

Ball mills, tube mills and revolving drums (chlorination barrels or similar leaching drums) are common representatives of the type of machines which require excessive starting torque. Hoisting machinery usually falls in this class also, but such machines as gyratory and jaw-type rock crushers, rolls, hammer mills, elevators and conveying machinery, dryers, jigs, concentrating tables and many


No. 3583
THIS SERVICE DISCONNECTED BY
ROCKFORD ELECTRIC CO.
AND MUST NOT BE TURNED ON
by anyone other than an employee of the Rockford Electric Company, UNDER PENALTY OF THE LAW.
Apply at the office of the Company at 116 South Wyman Street for Service.
No. 3583
.....191...
Disconnect
Nature of Business.....
Address .....
Reason for Disconnect.....
Remarks:

Tag With Tear-Off Coupon Used by Rockford Company in Campaign on Dead Services.

forms of roasting or calcining furnaces can readily be put into motion with squirrel-cage motors.

It is always doubtful economy to attempt to use a clutch pulley to take the place of the proper type motor as the additional first cost and upkeep will in most cases show a decided balance in favor of the proper type motor.

Great care should be exercised in locating motor drives in dry crushing plants owing to the presence of dust and grit which invariably accompanies operation. While there are some excellent designs of dust-proof motors being manufactured that meet such conditions, the most satisfactory solution of the dust problem where conditions will permit is to extend the drive shaft to a point which will afford a safety from this evil.

In the following tabulations is given the approximate horsepower required for various classes of crushing and pulverizing machinery. It is sufficiently accurate to serve as a basis for establishing the power requirements.

APPROXIMATE POWER REQUIREMENTS FOR VARIOUS COARSE CRUSHERS

Gyratory Crusher..	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7½	No. 8	No. 9	No. 10	No. 12	No. 18	No. 24
H. P. Required	6	10	15	20	26	40	70	100	140	175	200	250	300

Blake Crusher	4x10 in.		7x10 in.	9x15 in.	10x20 in.	15x24 in.
H.P. Required	4		7	12	20	25
Dodge Crusher		4x6 in.	7x9 in.	8x12 in.	10x16 in.	
H.P. Required		4	8	12	18	
Cornish Rolls 9x9 in.	12x12 in.	14x24 in.	14x30 in.	16x36 in.	16x42 in.	18x48 in.
H.P. Required 3	5	10	15	18	25	31

FINE CRUSHERS AND PULVERIZERS.

Universal Crushers	No. 1	No. 1M	No. 2	No. 2M	No. 3	No. 3M	No. 4	No. 4M	No. 5	No. 5M
H.P. Required	2-3	3-4	5-8	7-10	7-10	12-15	15-20	20-25	25-30	30-35

Symons Disk Crusher	24 in.		36 in.	48 in.
H.P. Required	18-25		30-40	50-65
Brainard Pulverizers	No. 0	No. 1	No. 2	No. 3
H.P. Required	8-12	12-16	20-25	40-50

Stamp Mills—H. P. for 10-stamp, 8-inch drop, 90 drops per minute.

Wt. of Stamps	750 lbs.	850 lbs.	1,000 lbs.	1,200 lbs.	1,600 lbs.
H.P. Required	15	17	20	25	32

Huntington Mills	3.5 ft.	5 ft.	6-ft. Standard		6-ft. Heavy
H.P. Required	5	8	12		17
Chilian Mills	5 ft		6 ft.		7 ft.
H.P. Required	15		25		50
Griffin Mill	42 in.				
H.P. Required	50-60				
Sturtevant Ring Roll	No. 2				
H.P. Required	70 to 80				
Fuller Mill	24 in.		33 in.	42 in.	57 in.
H.P. Required	10		35	50	100
Tube Mills	5 ft. x 22 ft.		5 ft. 6 in. x 22 ft.		6 ft. x 22 ft.
Starting H.P.	125		135		150
Running H.P.	50		60		100
Ball Mills	7 ft. x 7 ft.				
H.P. Required	60				

The opportunity to use the direct-current motor being so limited it has been purposely omitted in this article.

Data on District Steam-Heating Service from Central Stations Presented.

At a recent convention of electrical interests at Boston the subject of steam heating by central stations was extensively taken up. There is a division of opinion on the desirability of central-station operation of steam plants on the premises of manufacturers and in business blocks, where the power load is taken care of by central-station electric service.

Some plants present especially favorable conditions for electric company heating, and various devices and practices may be employed to gain advantage over the operation of the private plant, both as regards its power requirements and also its heating needs during the cold seasons.

V. M. Tallman, of the Worcester (Mass.) Electric Light Company, said a metered rate is vastly preferable to a flat rate for central-station heating. His company formerly metered only about 20 per cent of its service; now it meters about 48 per cent and with the same basic rates, receives 43 per cent more revenue than formerly, partly because of the better control of the customer's heating requirements. The company charges $1.50 per 1,000 pounds of steam condensed.

Heating of feed water, the elimination of high-pressure fire pumps, steam hammers, etc., the tightening of window construction, and re-piping where wasteful of radiation, are some of the ways in which heating can be economized. The use of automatic air valves on radiators was recommended.

G. F. Parsons, of C. D. Parker & Company, Boston, and A. C. Jordan, Cumberland County Power & Light Company, Portland, Me., spoke. The former said that losses from ventilation and heat losses should be carefully studied. Central-station men were urged to study a few buildings in which the cost of heating is known and check up the theoretical formula available. The Heating Research Committee of the N. E. L. A. is doing much to promote central-station heating, and desires all data obtainable

Mr. Jordan emphasized the importance of equipping radiator returns with traps and reducing coal consumption by modernizing piping systems and reducing pressures where possible. In one instance these steps resulted in scaling down coal used from 4 tons to 1.5 tons per day in coldest weather.

Sales Department of Minneapolis Company Holds Electrically Cooked Dinner at Low Cost.

A complete dinner for 20 members of the sales department of the Minneapolis (Minn.) General Electric Company prepared entirely on the electric range at energy consumption of only 0.3 kilowatt-hour per person, was the feature of the March meeting held by the employees of the company on March 20. The sales department meetings are usually held at a local hotel but because of the popularity of electric cooking it was decided that, in this instance, an instructive and interesting innovation would be to have the meal cooked by the members of the company's Electric Cooking Bureau, who, at the same time would keep very accurate records of just exactly what it would cost, and tabulate such items as time, weights, cost, shrinkage, etc.

The following results were obtained:

1.	Number of people served	20
2.	Total cost of supplies	$8.54
3.	Total K. W. H. used	6
4.	K. W. H. per person served	0.3
5.	Weight of roast before cooking	9 lbs. 10 oz.
6.	Weight of roast after cooking	9 lbs. 2 oz.
7.	Shrinkage percent	5.8%
8.	Total cost of current @ 2½c	$0.15
9.	Total cost of meal	$8.69
10.	Total cost per person, per meal	$0.434

All of the cake and rolls were made during the afternoon and baked on the electric range just before the dinner was served, and in addition to this, the two demonstrators and the range salesman waited upon customers all afternoon, so that it is unnecessary to charge any proportion of their time to the cost of the actual preparation of the meal.

The menu consisted of tomato soup, hot rolls, roast beef, baked potatoes, stewed apples, escalloped corn, cake, prune whip, and coffee. The roast was placed in the oven at 3:10 p. m. and taken out at 6 o'clock, it being done as near perfectly as possible. The range was placed in service at 2:30 p. m., so it can be seen that very little time was consumed in the preparation of the meal.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

WHY MOTOR MAINTENANCE PAYS BOTH THE CLIENT AND CONTRACTOR.

A True Story of the Experience of a Manufacturer Who Thought He Was Paying for Something He Did Not Get.

One day several months ago an electrical contractor, who enjoys a steady income from his motor maintenance department, opened his mail to find a canceled contract from a large manufacturing company that had been one of his best accounts. This company operates an iron foundry and has numerous induction motors, for individual drives. It is very likely that several times the manager of the company had noticed the maintenance man drive up, spend a half hour in his factory and then drive away, fathering the manager's thought that it certainly was "easy money." When business was not any too brisk and expenses were being cut, one of the first things he turned to was the maintenance contract—hence the cancellation.

It happened that the contractor's construction department was not very busy at this time and the cancelled contract had the effect of setting the contractor off on a "blue period" in which he bewailed the fact that his motor maintenance department was going to the "bow-wows." And there wasn't a single argument that had any effect on the manufacturer. He was through with the "needless expense" of motor maintenance, and that was all there was to it.

A month later the contractor received a telephone call from the manufacturer, who said one of his large induction motors was burned out, and that he wanted one to replace the disabled motor while it was being repaired. The contractor didn't feel any too accommodating, but he did the work and handed in a bill for repairs that totaled considerably more than a month's maintenance expense. Several weeks later the same incident was repeated, only this time it served to teach the manager the lesson that electrical equipment in the hands of inexperienced workers, such as foundry hands, is liable to suffer, causing costly delays and repairs. It is well to mention that both burnouts had been caused by carelessness and could have been prevented by the maintenance man.

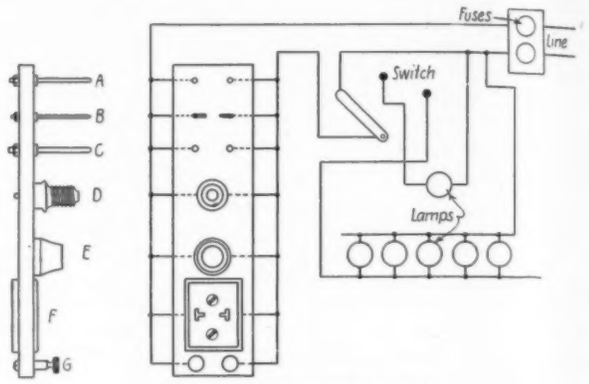
The company went back onto the contractor's maintenance list, a satisfied customer, and the contractor is guilty of chuckling whenever he is reminded of the incident.

Convenient Board for Testing Heating-Appliance and Other Cords.

By Harry Metcalf.

Repairing of flatiron cords and cords for other electric heating appliances, fans, etc., is becoming quite a business for electric shops. If means are at hand for doing this quickly and at low cost, it can be done with profit and satisfaction to all concerned. In the accompanying sketch is shown a testing board that I have found very convenient for this purpose. It can also be used for other tests, as will be described below.

The board is made of red fiber about 3 inches wide by 14 inches long and three-eighths or one-half inch thick. *A* is a pair of round-prong contacts such as used on Simplex heating devices; *B* is a pair of flat contacts, like the Hotpoint type; *C* is another pair of round contacts or contacts of other types that are used extensively on heating devices sold in the particular district; *D* is the end of a Hubbell screw plug; *E* is an Edison screw base receptacle; *F* is a Hubbell flush receptacle with T slots; *G* is a pair of binding posts for miscellaneous testing.



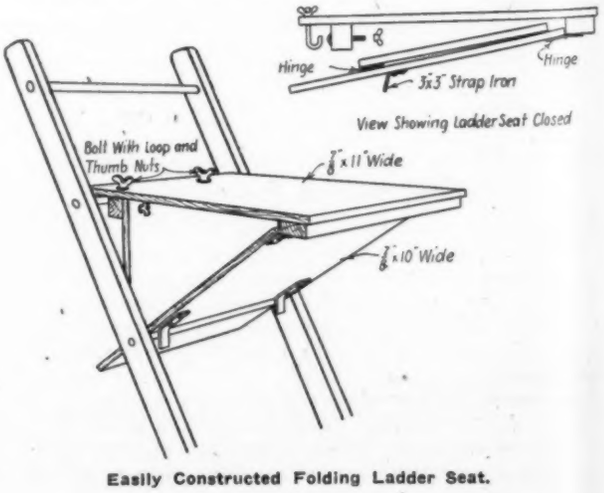
Simple Cord-Testing Board.

The connections are shown in the middle and right side of the sketch. A three-point switch permits throwing full voltage across the contacts, etc., or placing one or a group of lamps in series with them. With this arrangement it is possible to test almost any cords, as well as fuse plugs, lamps, etc. Lamps and fuse plugs are tested in the receptacle *E*. Sockets are tested on the plug end *D* or at the binding posts *G*. If occasion requires, other plugs or receptacles can be added and the scheme readily extended for other tests.

Folding Ladder Seat.

By Walter Morris.

A safety platform to fit on a straight ladder was described in the issue of February 24. I have had occasion to do considerable work from ladders and have found it much more comfortable to use a handy folding seat in place of a platform to stand on. This seat is quite easily made as shown in the accompanying double sketch. The



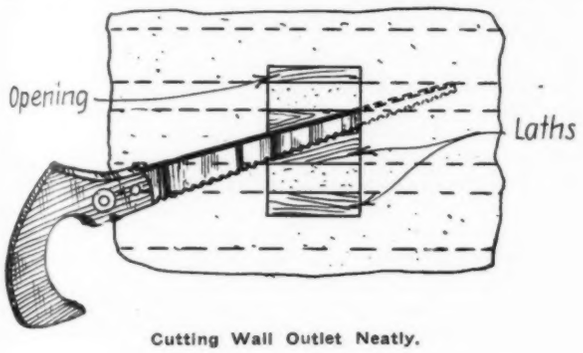
Easily Constructed Folding Ladder Seat.

lower part shows the seat opened and attached to a ladder. In the upper corner is shown a side view of the seat folded or closed. It requires merely three pieces of seven-eighths-inch board hinged together with stout iron hinges, two cleats, two carriage bolts and two loop or J-shaped bolts, each with thumb nut, and two pieces of strap-iron bent as shown. Such a seat can be made with little trouble. It can be set up on or removed from the ladder very quickly and is strong.

Cutting Pockets for Flush Wall Switches Without Spoiling Plaster Edge.

By Ralph O. Bates.

Most of the walls of ready built houses are either hard-finished and painted or are rough-finished and tinted, which causes more or less trouble in the cutting of the openings for flush switches, by the plaster breaking away to



Cutting Wall Outlet Neatly.

such an extent that the plate will not cover it. To avoid this I find the following method a very good one.

After the height for the switch is located, punch with your screw-driver a small hole between the laths, then place the back of the switch box (if you are using the type A. A. boxes), against the wall with the bottom or lower edge about one-fourth of an inch below the upper edge of the lower lath and with a pencil mark around the box. Upon cutting away the plaster you will always find you have part of the lower lath, all of the middle lath, and part of the upper one to cut away. This leaves a solid place for the screws. Next with a sharp knife cut through the paint and hard finish, where you have marked, then finish cutting through the plaster with the corner of a chisel and carefully remove it, leaving the laths to be cut. This may be done either with a hack-saw blade or a keyhole or compass saw and great care must be taken not to let the teeth of the saw strike the edge of the plaster on the outward stroke, or you are sure to break a piece out. This can be easily avoided if you will hold the saw at an angle as in sketch so that it cuts on a bevel.

This method is already in use by many careful electricians, but I find many cases where wall switches are clumsily and unsecurely installed with the plaster broken away so badly as to show beyond the edges of the face plate.

Straightening Wire.—Of all the many methods used for straightening wire that has become twisted or kinked, I believe that the one shown in the sketch herewith is the simplest and probably best. The part of the hammer used is smooth and round and does not injure the insulation of the wire. This method is quick and reliable. One end of the wire may be fastened to any convenient support or held by a helper if he is at hand. Walter Morris.

Simple Method for Straightening Wire.

Alabama Electrical Contractors to Organize.

A meeting of electrical contractors of Alabama was held at Birmingham, March 20, for the purpose of forming a state organization. The meeting was addressed by Robley S. Stearnes, of New Orleans, president of the National Electrical Contractors' Association, and by Joseph A. Fowler, of Memphis, member of the executive committee of the national organization.

Among the Contractors.

W. B. Roach and Walter Stephenson have opened an electrical store in Darlington, Wis.

E. J. Heilman has purchased the electrical contracting and supply business of E. J. Hayes in Hutchinson, Minn.

P. C. Wallichs, of Fond du Lac, Wis., is building an addition to his electrical establishment on South Main Street, to be used as a charging station.

NePage-McKenney Company, Portland, Ore., has been awarded the contract for electrical installations in five wooden motor ships for Libby, McNeil & Libby.

The Leighton Engineering Company, Seattle, Wash., was awarded the contract for wiring in Western Avenue Realty Company Building, in that city on its bid of about $2,500.

J. C. English & Company, of Portland, Ore., was awarded the contract to furnish and install the electrical fixtures in the new high school at Roseburg, Ore.

H. C. Thurston has moved his electrical shop in Ukiah, Cal., to a larger location in the Herer Building. He has increased his stock of fixtures and has made improvements in the repair department.

E. F. Kelly, of Conrad, Mont., and Charles Flynn, of Newport, Wash., have formed a partnership and opened an establishment in Conrad for handling electrical supplies and doing contract and repair work.

An electrical contracting and supply house has been opened at Homestead Fla., known as the Homestead Electrical Supply Company. The company is anxious to receive catalogs from manufacturers of electrical supplies and fixtures.

H. E. Bixby and E. G. Frank have formed the Burley Electric Company at Burley, Idaho, and will carry on a general electrical engineering, contracting and repair business. A stock of electrical supplies and fixtures will be maintained.

The Armstrong Construction Company has been incorporated to engage in electrical contracting work at Lansing, Mich. The office of the company is in the Prudden Building. E. A. Armstrong is president; Arthur R. Sawyer, is vice-president, and Charles M. Armstrong is secretary and treasurer. President Armstrong has long been actively engaged in electrical construction work, having been until March 1 construction engineer for W. T. McCaskey & Company, Lansing, Mich., builders and contractors of public utilities.

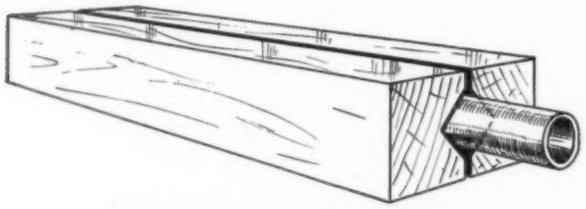
DOLLAR WIRING KINKS

All readers are invited to contribute to this department. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; if a diagram is necessary, a rough pencil drawing will serve. The idea itself must be new and bright. A dollar will be sent to the contributor upon publication.

To Cut Fixture Casing Exactly Square.

A kink on this subject published in the issue of March 10 described the use of a piece of conduit with a set screw. I do not consider this a very practical method for the following reasons: When manufacturing fixtures the casing is almost invariably finished and lacquered before it is cut. On pushing a piece of finished casing into the conduit the latter would very likely scratch it; moreover, tightening it with a set screw would undoubtedly dent the casing.

To overcome these difficulties I use the following method



Blocks for Holding Fixture Casing.

very satisfactorily: Take two pieces of wood, each about 1.5 by 1.5 by 12 or 14 inches. Square up the ends. In one face of each piece cut a deep V slot lengthwise. Cover the slots and their long edges with cloth by carefully gluing it on. It is desirable, though not absolutely necessary, to loosely secure the two pieces together by putting two or three wood pins or pegs in one piece to fit into corresponding holes or sockets in the other piece; this insures them properly lining up when put into the vise. On putting the casing between these blocks in the vise it can be quickly and squarely cut off close to one end of the block. Another way to make the two blocks is to first take a long strip, 1.5 by 0.75 by 48 inches, bevel off one edge evenly, then cut into four pieces, each 12 inches long. Now glue or nail together two pairs of these pieces and then cover the slot with cloth.

I also find it a good plan to tack on the top of one of the pieces a penny ruler, so that I can cut the casing to any length desired without first measuring it, then marking and finally inserting it between blocks. C. S. Ellison.

Cementing Porcelain.

When fastening a porcelain-base switch or receptacle on a glazed-tile wall where a fastening on one screw only is possible, I have found that a mixture of sodium silicate (water glass) with whiting makes a very good cement to fasten the base more solidly onto the tile. This mixture when set forms as hard as glass and can also be used to repair broken porcelain insulation. R. R. Knoerr.

Making Close-Up Threads Straight.

In conduit or other pipe work a thread close up to an offset or an elbow is sometimes convenient or even necessary. To make this, set the dies at standard mark or other desired point in the stock, then turn them over, reversing them in their sockets. As a guide use next smaller size, which fits inside the pipe to be cut, with collar to match in place of the collar matching the dies. By placing this small pipe in the end of the conduit or pipe to be threaded, then proceeding as usual a perfectly straight and close-up thread can be obtained. Herbert G. Stoddart.

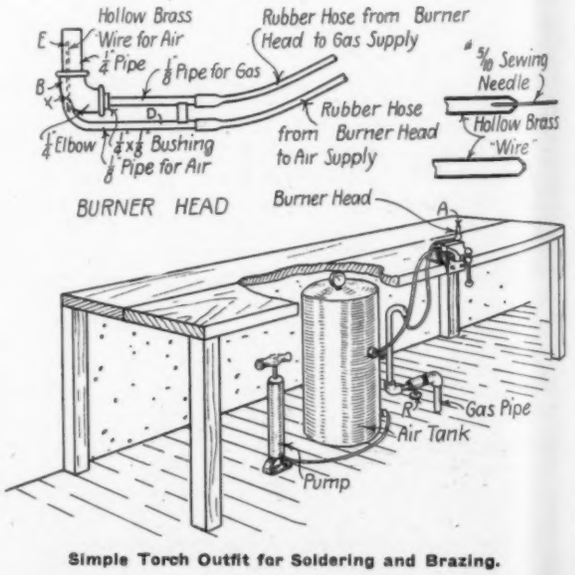
Home-Made Tool for Splitting Duplex Wire.

Difficulty is frequently met by the electrician in splitting duplex wire without cutting into the covering of the individual wires. To overcome this I use an old three-pronged steel fork as follows: Bend the middle prong backward and sharpen it so it will cut like a knife, then bend it forward nearly half an inch in front of the side prongs. The latter serve (when narrowed a little) to guide the middle prong or blade so as to cut the outer braid evenly without damaging the insulation of the wires.

James Burns.

Economical Soldering and Brazing Outfit.

In our shop we have gas piped to our work bench, but as a soldering outfit it was found too slow to heat the soldering coppers. We therefore made a very effective outfit at a slight cost as most of the parts used to build it were found around the shop. The accompanying sketch shows the arrangement of the outfit and some of the details. The scheme consists in applying air pressure to the gas burner so as to get almost as hot a flame as the acetylene welder. The tank used is an old gasoline tank made for the so-called "hollow-wire" Pitner gasoline-lighting system. We took the "hollow-wire" valve off at the base of the tank and inserted a Schroeder automatic check valve and connected a foot pump to this valve. This makes it unnecessary to tighten up the valve after applying air pressure with the pump. At the upper valve on the side of the tank we fastened a rubber hose and this was attached to the air pipe on the burner head. This burner head is home made also and is composed of several pipe fittings. We took a one-fourth-inch elbow *B* and drilled a small hole into its sides in which was inserted a piece of the "hollow wire" used on the Pitner system; this is shown at *X* on the sketch. The air pipe *D* must be securely soldered to the elbow *B* so that no air can escape. This burner head can be entirely made of brass as it is much easier to solder than iron, of which our outfit is made. The next important thing is to make a needle end tip in the "hollow wire" so that a concentrated jet of air will pass through. This can best be made by inserting a sewing needle (No. 5/10) inside of the "hollow wire" and squeezing the sides together with the pliers, as shown in the detail sketch. This "hollow wire" or air supply tube *E* is now inserted. It should be about one-fourth inch shorter than the gas burner tube *A* to get the best results. After connecting the pipes and rubber hose all is ready. Apply about five pounds air pressure, open the air valve on the tank and the gas valve or cock and light the burner at *A*. By adjusting the gas valve the flame can be drawn down from a flare to a needle point for delicate work. J. C. Walsh.



Simple Torch Outfit for Soldering and Brazing.

DEALER AND STOREKEEPER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Storekeeping for the Dealer in Electrical Appliances

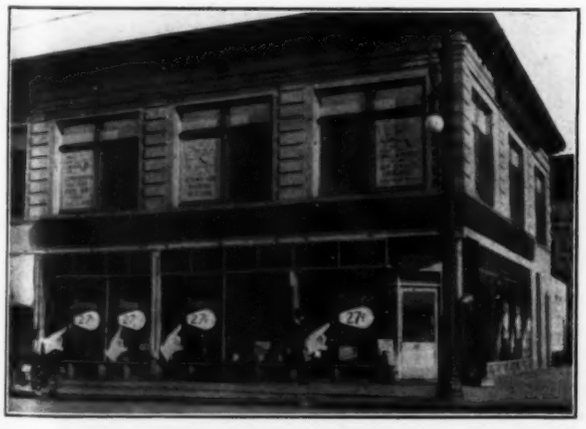
Use of Signs to Increase the Efficiency of Display Windows.

By Ira R. Alexander.

Store windows, according to Henry Cahn, general manager of the Cahn-Forster Electrical Company, of Denver, Colo., can be made to play an important part in the increasing of sales for the man engaged in the electrical merchandise business. The Cahn-Forster store is located in a part of the city where thousands of people pass it daily. In order to attract the attention of these people large signs are painted on the glass of the display windows of the store.

The accompanying illustration shows how the Cahn-Forster firm made use of their windows in announcing a sale of Edison Mazda lamps recently. These windows served to draw a great deal of trade to the store and they proved the worth of the advertising scheme. The signs on the windows fixed this store in the minds of the people when they thought of Mazda lamps, and it also served to bring people into the store who had never been there before and, of course, sales in all other departments were materially increased and new customers were made.

"The painting of large signs on the glass of our windows brings us increased business," said Mr. Cahn recently in speaking of the matter. "We find it a very paying way of advertising. It attracts attention from people passing our store on foot, in automobiles, on street cars and in other kinds of vehicles. An ordinary window display would not attract the attention of people passing in vehicles or on the other side of the street, but our signs can be seen for a long distance and they reach out after and bring in trade that a small window card, or a large one for that matter, could not get hold of. The signs give us a good deal of



Use of Signs In the Windows of this Store Increased Efficiency of the Displays.

notice and when people are in the market for anything they have seen pictured on our display windows they are pretty apt to recall seeing the signs on our windows and so come to us.

"We aim to change the signs on our windows every week or so. If the same sign is left on the window too long it loses its drawing power. A merchant in using signs on his windows should not stop there, but he should back them up with attractive window displays. The large signs will draw attention and people will come nearer and look into the windows for a closer inspection and if they do not see something worth looking at the power of the signs on the windows drop. Have well arranged window displays and change them often—this coupled with painting large signs on our windows gives us advertising that increases our business every day of the year."

Helping to Modernize Old Buildings by Installing New Lighting Fixtures.

Public institutions of all kinds are legitimate prospects for the installation of new systems of lighting. While many of the buildings are old they are of substantial construction, and will be used for a long time to come; and those in charge of them are anxious to make whatever changes are desirable in order to bring about as great a degree of modernity as they can.

Hospitals, for example, can be greatly improved by the use of modern lighting systems. This feature is of prime importance in a hospital because of the bad effect which direct lighting often has on sick people. The appeal can be made here both from the standpoint of improving the appearance of the hospital, and likewise making it a more efficient place for making sick persons well.

In a hospital with which the writer is familiar there was not enough money available for making a complete installation of new fixtures. But the dealer who had interested the superintendent made arrangements to install the system piecemeal. It took a number of months to complete the job, a few fixtures being put in here and there as funds permitted. But finally it was finished, and was a credit to the institution and the electrical merchant as well.

Window Display Gains Publicity by Arousing Play Instinct.

A big crowd gathered around a cigar store in a Middle Western city a few weeks ago was found to have resulted from an arrangement whereby the man outside the window could operate a device on the inside. The device was a wheel, operated by a small motor, and the connection with the motor was established for the outsider by a push-button system. When the button was pressed, the wheel turned around, and if it stopped at a certain point, the operator got a cigar.

The plan was a big success, as far as getting publicity was concerned, and that, presumably, was what the dealer was after. The fact that the passerby could work the device, which amounted to playing with it, was the important feature, for the play instinct is developed in everybody. By a simple electrical connection, a big section of the public which ordinarily would not have stopped to look in the cigar dealer's window was interested, and a display which would have been almost valueless was thus made extremely successful.

It is well-known that motion in a window display is of great assistance, on account of the eye-catching effect of a moving object, and the plan referred to uses this feature while at the same time developing the other as well.

The Importance of the Electrical Dealer

As the Intermediary for Manufacturer and Jobber the Dealer Is a Prominent Factor in Almost All Systems Devised for Placing and Keeping Electrical Appliances in the Hands of Consumers

By G. D. CRAIN, JR.

THOUGH it is probably true that the electrical dealer, as such, is a comparatively recent product, it is also true that he has shown that he is quite indispensable in the distribution of electrical appliances.

Created by the necessities of the situation, he has risen to the occasion by making it possible for the consumer to get the intelligent service and the technical information which he requires before he will invest his money, and the result is usually more business for the manufacturer and greater satisfaction for the user—a combination which, it will be conceded, very nearly approaches the ideal.

Most of the big manufacturers of electrical goods have regarded the dealer as the logical factor in the sale of their products. But there are many others, especially small concerns just breaking into the field, who have attempted to get along differently, and the story of their experiences would fill volumes. It is interesting to note that however their selling plans begin, they usually end with a lot of stress being laid on the electrical merchant, because the latter has been found to be supreme in his own town and neighborhood.

Difficult to Market New Appliances Without Dealers' Aid.

Those who are familiar with the selling situation in the electrical field often wonder at the apparent hardihood of concerns which attempt to market their goods without the aid of the dealer. But this is not to be wondered at, and in the nature of things is to be expected. The man who has originated a new method of applying electricity, who has developed an appliance for which there is an obvious market, becomes so enthusiastic over his product that he forgets that he will have to kindle a fire of interest sufficiently hot to melt the frigid exterior which surrounds every "signature on the dotted line."

Mr. Emerson has been quoted on the subject of the beaten path and the house in the woods, the inference from which is that if a product is only good enough it does not need to be "pushed," in the modern sense of the word. But there are hundreds of electrical manufacturing concerns, with products of obvious utility, which have learned that it is necessary to construct a broad highway, and to establish road signs and complete data before tourists will undertake to make their way there. No matter how good the product is, the marketing methods must be correct before success can be won on any considerable scale.

The dealer is a great asset to any manufacturer, but he is especially valuable in the case of the concern with a limited amount of capital. The manufacturer with a single specialty finds that his overhead is necessarily high, and if he is not able to use the effective and economical plan of dealer distribution the expenses connected with his sales promotion work will soon become prohibitive. The sincere support of the dealer often makes it possible for a concern of this type to "get by" until its business broadens sufficiently to carry the load without difficulty.

There is a certain concern in Chicago which makes an electrical device which has a sound idea mechanically and commercially. That is to say, the device works, and there is a market for it; but, as usual, it was discovered that the market would have to be developed, just as a field is developed by cultivation. It would be as absurd to expect a piece of land, no matter how fertile, to produce crops without effort on the part of the farmer as it would be to ask for business without promotion work, just because it is conceded that there is a potential market for the product.

Why the Mail-Order Plan Failed.

This concern experimented along a number of different lines before it finally got on the right track. Its first method, adopted right after it got into the game, was to sell by mail. The idea was to interest the prospect to the point where he would be willing to buy the appliance and accessories and hire his own electricians to install them. The plan looked attractive because the field for the sale of the product was well defined, and because it was comparatively easy to get inquiries as a result of advertising and circularization work.

But the plan did not work. Too few people were willing to go to the trouble involved in handling their own installation, while the cost of the appliance did not warrant sending out a crew from headquarters. The manufacturers thus went through the disappointing experience of finding a comparatively ready response to the appeal made on the basis of the utility of the product, but all too few actual sales put on the books. The expense of running the business, of course, continued right along.

Canvassing Proposition Also Fails.

Then it was decided to get agents or canvassers, who would make the rounds of the prospective users, and try to get them to install the outfits. A number of such representatives were secured, though this was not easy. In fact, it proved next to impossible to get men who were possessed of the necessary selling ability and at the same time had any knowledge of electrical work or the features which would have to be taken into account in making an installation. To have carried out the plan of direct representation, as originally outlined, would have called for the organization of a corps of "sales engineers," trained at the factory along technical lines, and prepared to deal with the prospective user by showing him just how the appliance would be installed and how it would work.

The canvassers who were actually secured got inquiries, and sent in a lot of questions for the heads of the concern to answer, but they too fell down when it came to making sales, simply because they did not have the knowledge which was needed to convince the prospect that he should make a test of the device. And inasmuch as they did not make enough sales to pay for their time, the canvassing organization gradually disintegrated and left the manufacturers with no alternative except to put their case before the electrical dealers.

Dealers the Successful Retailers.

This was tried out tentatively. An inquiry came along from an important user, who was given information about the product. There was no further response, however, and the regulation "follow-up" did not produce the business. It was then decided to turn the inquiry over to a local electrical concern, with which arrangements were made for the installation of a trial outfit, if the customer could be interested. The dealer took hold of the proposition aggressively, got the trial installation in, and after a success-

ful test secured an order for a complete installation, the whole job running in excess of $2,000.

The manufacturers were amazed at the smooth way in which the proposition had been handled. Their eyes were opened to the possibilities of real dealer co-operation, and they promptly set about securing dealer representation in other cities. Now their plan is to use their promotion work for the purpose of developing prospects, and then close these prospects with the aid of the dealers. Some of the latter need to be educated on the "selling talk" which has to be made, and to be prodded occasionally for lacking aggressiveness in following up inquiries; but the general results of the plan have shown that it is the only practicable method which has ever been tried, and by reason of it the business is being rapidly put on a sound and substantial basis.

Dealers Can Keep Good-Will of Appliance Users.

There is another good reason why the dealer is indispensable to the electrical manufacturer, and especially the concern with a new product. It may be said freely and frankly that sometimes new appliances, no matter how carefully tested out in advance, do not always give perfect service. Conditions may be developed which had not been anticipated; uses may be attempted for which no provision was made, and so on.

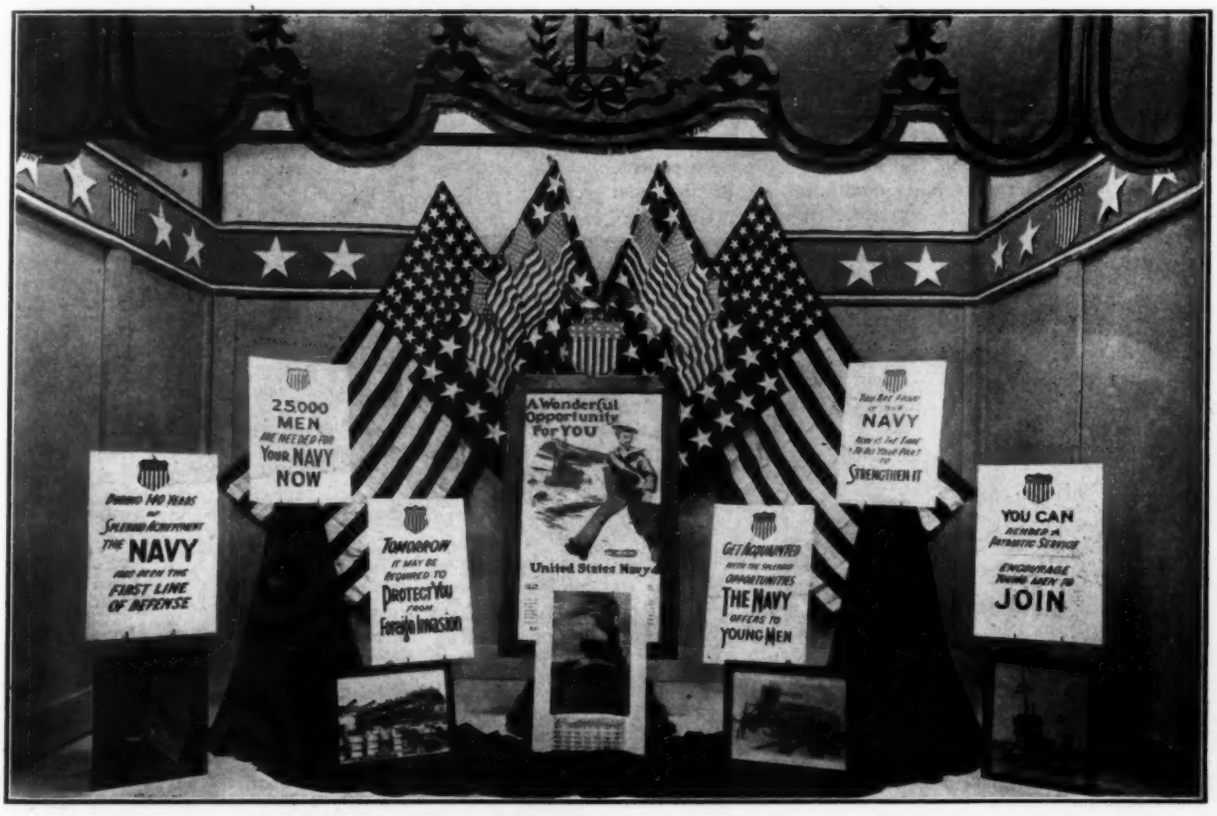
In this case, if there is a dealer handling the business, no serious trouble develops. The dealer can examine the appliance, and if it can be put into good order without removal, this is done at minimum expense and trouble. If it must be replaced, this also is determined, and the manufacturer knows just what the conditions are. Without a representative to adjust complaints of this kind, the user becomes irritated because of the lack of service rendered, and the good-will which should have been generated turns to ill-will—just as sweet milk "turns" as the result of a thunder-shower.

Benefits from Maintaining List Prices.

A successful manufacturer of electrically driven appliances has a retail price which he maintains invariably, no matter how big the order, which is always handled through the nearest dealer. This is not pure philanthropy on his part, but is the result of his knowledge that there may be trouble some time later. If there is trouble, he wants to be able to call on that dealer with assurances of enthusiastic co-operation. Maintaining the list price also results in people being willing to have the goods delivered regularly through their local dealers, instead of trying to buy direct and get the dealer's discount off; and this makes for better relations and greater assurances of service.

There aren't many manufacturers of experience who are trying to get along without the electrical dealer; and as for the latter, he is getting bigger and stronger and better able to render the sort of co-operation which makes for increased sales and increased satisfaction on the part of purchasers of electrical goods.

Will You Help the Navy Obtain Recruits?


25000 MEN ARE NEEDED FOR YOUR NAVY NOW
A Wonderful Opportunity For YOU
United States Navy
NAVY
STRENGTHEN IT
DURING 140 YEARS OF SPLENDID ACHIEVEMENT THE NAVY HAS BEEN THE FIRST LINE OF DEFENSE
TOMORROW IT MAY BE REQUIRED TO PROTECT YOU FROM Foreign Invasion
GET ACQUAINTED WITH THE SPLENDID OPPORTUNITIES THE NAVY OFFERS TO YOUNG MEN
YOU CAN
JOIN

A navy display in one of your windows, such as shown herewith, will give excellent publicity to a phase of preparedness in which every one is vitally interested at this time. The navy needs men and needs them now, and every patriotic dealer should do his part in furthering the work of stimulating enlistments. The display illustrated has all the merit of the ordinary patriotic display, with the additional advantage of accomplishing something of definite assistance. Against the background, two Union Jacks symbolic of the Navy are draped. At either side of these American flags are draped. Across the upper edge of the background extends a border of dark blue crepe paper, edged with red, white and blue. White stars are cut from cardboard and pinned to the border. Shields of red, white and blue are used at the ends. These are cut from crepe paper. The centerpiece of the display is a recruiting poster, borrowed from a Recruiting Station as were the photographs and calendar in the foreground. At the upper edge of the poster is a unit composed of American eagle and shield with six flags. This material as well as the shields used to embellish the show-cards, can be bought in any stationery store.

NEW APPLIANCES

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

New Chelten Snap Switch

The Chelten Electric Company, 314 Armat Street, Philadelphia, Pa., is preparing to place on the market about May 1, a new snap switch which at first will be made in the smaller capacities in the single-pole, double-pole and three-way types. Later it is expected to make the switch in larger capacities also. This switch is especially designed for places where a neat, compact and light switch is required with a quick, firm and positive action. These ideas were incorporated in the design of the new switch, which the manufacturers state embodies all of the best features of modern switch practice. These switches are to be manufactured in both the indicating and non-indicating types.

New Snap Switch.

New Trumbull Wiring Devices.

The movement for standardization of contacts in plugs, receptacles and similar devices made much headway recently when some half dozen manufacturers of these devices agreed to so modify their products as to make them interchangeable. This is believed to be particularly advantageous in that it will promote more liberal use of electrical appliances which has been hampered somewhat by requiring the use of special plugs to fit the particular receptacles that happened to be installed.

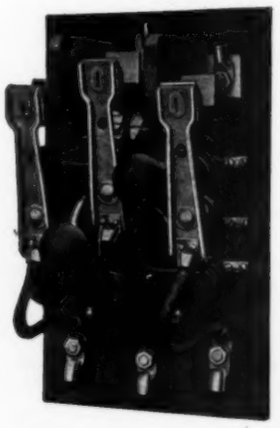
The Trumbull Electric Manufacturing Company, Plainville, Conn., has joined this movement for standardized contacts and has recently brought out a number of devices that are interchangeable with corresponding products of other makes of "standard" devices. Fig. 1 shows a new "standard" flush wall receptacle body which it will be observed has provision for receiving both parallel-blade and tandem-blade attachment caps. Fig. 2 shows a porcelain side-outlet current tap with standard composition cap; the side outlet is for series connection. Another device is a compact separable attachment plug with standard cap; this plug is made of a fireproof and durable composition material.

Fig. 1. New "Standard" Flush Receptacle Body.

Fig. 2. Porcelain Side Current Tap with Composition Cap.

New C-H Remote-Control Switches.

The accompanying illustration shows the new remote-control switch made in single, double and triple-pole types, by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. The design is such that current is consumed only at opening and closing, a mechanical latch holding the contacts closed after the switch contacts are closed by magnetic force. The use of this switch is thus very economical of energy. The same type of contact fingers is used as on other C-H control apparatus, many types of which, such as drum crane controllers, must stand the most severe service. The contacts are of cold-rolled copper and are kept clean by a wiping motion in closing. Two solenoids are used, one for closing and one for opening the switch. The solenoids are energized by circuits connected to push-button control switches, which may be placed where desired.

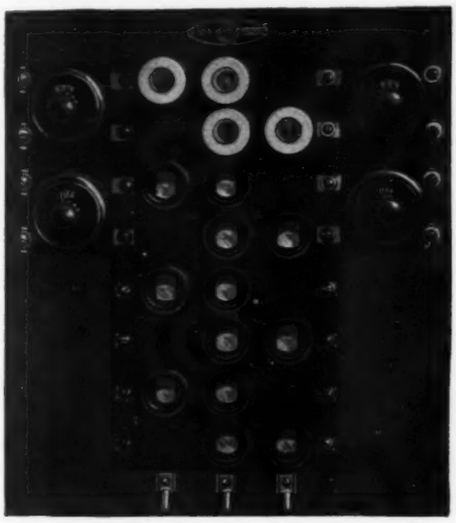


New Remote-Control Triple-Pole Switch.

These new switches are of 100-ampere capacity and made for both alternating and direct-current circuits. They are particularly suited for the control of lighting circuits from a distant point or central location. In large buildings, factories, theaters, etc., remote-control saves needless use of energy and makes unnecessary the running of the circuit wires over long distances to a desirable control location. On burglar lighting systems the remote-control switch is also used to great advantage in permitting instant control of all the lights or at least one in each room throughout the house, the control being by means of a simple push-button master control switch.

Safety Cutout Units for Panelboards.

An interesting development in equipment for panelboards is announced by the Chicago Fuse Manufacturing Company, 1014 West Congress Street, Chicago. As shown in the illustration, this device combines the simplicity of the porcelain cutout with the finished appearance of the busbar type of panel. The most important feature is that it does away with the many exposed live parts, which are a continual hazard and which quickly corrode and thus produce the possibility of poor contact between the copper current-carrying parts.



New Safety Cutout Unit for Panelboard Construction, Showing Method of Adding Branch-Circuit Switches.

On a slate panel are mounted three busbars each one-eighth inch thick and one inch or less in width, depending upon the number of circuits required. Over these bars are mounted the safety cutouts, each being attached firmly to the slate base by means of two screws. In the base of each cutout are three grooves each one-eighth inch deep by one and one-thirty-second inch in width, the extra thirty-second being to allow for irregularities in copper bars and to facilitate mounting. These grooves in the base are separated by the required three-quarter-inch space.

When the fuse plugs are screwed into the cutouts they make firm contact directly with the busbars. All connections between the shells of the cutouts and the terminals are embedded in the body of the cutout and are completely concealed.

The body of the cutout block itself is molded under great pressure from an improved insulating composition. This is not fragile like porcelain; it has high mechanical and dielectric strength and will withstand a heat of 400 degrees Fahrenheit without injury. This composition, as well as the cutout as a whole, is approved by the Underwriters' Laboratories.

This type of cutout is designed for use on three-wire circuits, but it can also be used with equal facility on two-wire, 125-volt circuits by connecting the two outside busbars together. The material of which the cutouts are made is black in color, which harmonizes with the slate upon which they are mounted. The dimensions of the cutout units are three inches wide, six and one-half inches long by seven-eighths inch thick from the slate base to the top of the walls around the fuse plugs.

Main fuses or a main switch can be added easily to the busbars at the top or bottom of the panel. If additions are contemplated to the panel, the slate base and busbars should be made of a corresponding height and it will then be a very simple matter to add more cutouts as required without removing the slate base from the cabinet. If it is desired to add snap switches for the individual branch circuits, these can easily be mounted by means of short connecting straps.

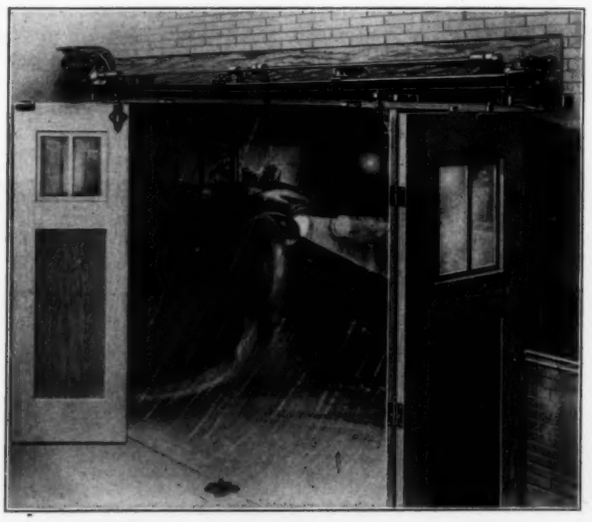
Aside from the other advantages already referred to, this panel cutout is of very simple construction, very quickly assembled to provide for any number of circuits, is very compact, neat and finished in appearance, and its cost is lower than the busbar type of panel, yet the finished panel is smaller and safer.

Electrically Operated Garage-Door Equipment.

Speed, convenience and comfort are prime considerations in the development of refinements for the motorist. All of these are incorporated in the automatic garage-door equipment illustrated herewith, which is manufactured by the Allith-Prouty Company, Danville, Ill. This company has long studied the requirements of modern garages as to door hardware and has developed equipment suitable for the variety of conditions met with. It has manufactured hardware for sliding, hinged, trolley-swiveled, folding, and combination doors of various types.

The particular equipment shown, which is known as the "Electromatic" door-opening and closing hardware, has been developed for motorists that appreciate the three features enumerated at the beginning of this article. An electric motor operating on the lighting circuit opens and closes the doors automatically without the motorist having to do more than put out his hand to throw the switch, which as shown is a decided convenience, especially when the weather is disagreeable. The doors open or close in four seconds and the car can be driven in without delaying more than a small part of a minute. Aside from saving the motorist's time, this insures a minimum chilling of the garage in very cold weather.

The outfit can be installed on any opening where the headroom is 12 inches or more. The mechanism is controlled by two push buttons placed where desired. Pressing the opening button turns on the lights, unlocks doors, and folds them back to clear the opening. Pressing the closing button reverses the operation. Pressing the initial button stops the doors instantly. The buttons or switch, when placed outside of the building, may be operated with a cylinder lock.



Electrically Operated Garage-Door Equipment That Can Be Controlled Without Leaving the Car.

In cases of emergency, such as power being off, etc., a slight pull of a lever disengages the gears and the doors

can then be hand-operated. Both doors are mechanically connected, so that the opening of one section also opens the other. Provision has been made through a spring checking device to prevent accidents to persons or machines, should they by oversight, be standing in the opening after the starting switch has been thrown.

This electrically controlled door hardware is manufactured from the highest grade steel and malleable iron and will stand up under the most exacting service. The outfit is motor-driven through worm gears to the operating shaft, which reduces the number of parts, making practically a troubleproof device.

After each part is tested it is assembled, complete with a standard motor, on a heavy plank for shipment. This plank can be used as a template for installation.

New General Electric Ornamental Street-Lighting Units Installed in Buffalo Suburb.

The city of Buffalo, N. Y., recently installed a new type of ornamental residential street-lighting unit, in one of its suburbs. This new unit is not only attractive, but also efficient in operation, and economical to install.

In many residential sections it is necessary or desirable to use only small sized lamps, chiefly because of the presence of trees and also to get more uniform illumination. Because of a demand that the installations be decorative, these lamps have usually been mounted on the tops of ornamental posts, the lamps being surrounded by opal balls. It has been apparent to anyone who has seen them that these globes almost invariably threw a large part of the light upward and this light has been lost as far as lighting the street surface was concerned.

The new unit does away with this waste of light. An artistic fixture contains in its upper portion the prismatic refractor used to collect the upward rays of the 100-candlepower Mazda type C lamp used in this case for a light source and redirects the light outward at a slight downward angle, illuminating the street surfaces well on toward the next post. The posts are staggered, that is, arranged alternately on opposite sides of the street. The light from each unit is well distributed over a large area so that there is increased and more uniform illumination of the entire roadway and sidewalk. A minimum number of posts is required by this arrangement.

The old method of lighting is extravagant when there is nothing of importance to illuminate above the lamp, but it has been necessary in the past to sacrifice this large amount of light for the sake of the ornamental effect usually desired in fine residence districts.

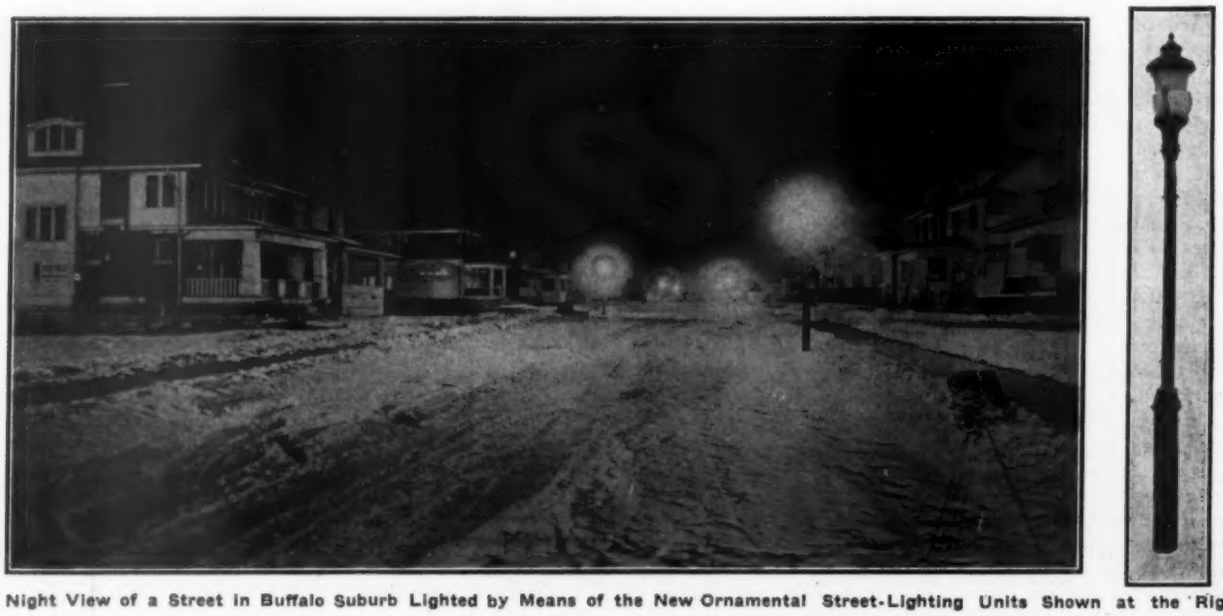
This new unit is the latest addition to the General Electric Company's many types of street-lighting fixtures. At the top of the fixture is a ventilated cap. Directly below it is the prismatic refractor, which is a double, concentric band with smooth outer and inner exposed surfaces; the prisms are on the two inside surfaces that are sealed at top and bottom to exclude dust and dirt. Below the refractor is an opal diffusing globe that minimizes any possible glare from the light rays radiating in the zone near the post. The entire unit is designed to give efficient and fairly uniform distribution from a relatively small number of units quite widely spaced. In comparison with upwardly turned opal-ball units with equal lamps, spacing and mounting height, the new units give nearly 50 per cent more illumination between lamps than the older type units. The entire equipment is weatherproof.

The Davis Motor-Driven Tag Marker.

The marking of price tags, in dry goods and department stores particularly, is a slow and tedious task if done by hand. The simple motor-driven tag marker shown, which is manufactured by the H. G. Davis Manufacturing Company, 4131 Frankford Avenue, Philadelphia, Pa., changes all this. By its use 2,400 tags can be printed in an hour.

The mechanism of this tag marker, which is driven by a 1/20-horsepower Westinghouse electric motor through a worm and gear, consists of a set of cams which move an endless chain of aluminum trays beneath a miniature type chase. The tags are printed as they move along on these trays. The trays are hand fed. A tag is placed in each tray beneath a clip which holds the tag in place from the time it is fed into the machine until marked by a downward movement of the type chase. This insures uniform register of the marking. When the tag is printed it is automatically released from the clip and discharged from the tray at the end of the machine.

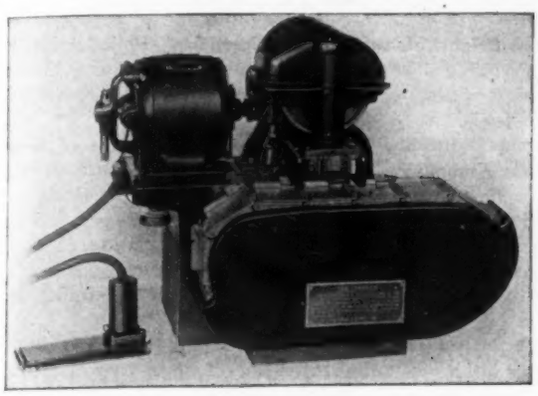
The machine will accommodate any size or shape of tag up to 1.75 inches wide, of any thickness from thin paper up to cards of 3/32 inch thick. The type chase is adjustable to adapt it to various sizes of type and is capable of marking as many as 7 lines, with 15 small characters or 9 large characters on a line. The type commonly used is of metal, full 12-point (one-sixth inch high). With the



Night View of a Street in Buffalo Suburb Lighted by Means of the New Ornamental Street-Lighting Units Shown at the Right.

usual setup of the chase, it is possible to print both the tag and the stub with the words Lot, Size, Price and some other word, if needed.

This tag marker is compact, portable, very quiet in operation due to the worm drive, and only weighs 45 pounds. It is furnished complete with a type drawer conveniently



Davis Motor-Driven Tag-Marking Machine.

arranged at the back of the machine, and is finished in black japanned enamel. All gears and mechanism are thoroughly protected. The motor leads are brought out through cord and plug for attachment to any lamp socket. In addition, a foot switch is provided by which the operation of the machine is controlled. This foot switch may be detached easily, thus preventing unauthorized persons from operating the device.

New Tungar Rectifier for Garages and Service Stations.

To meet the demand for a device that will transform the 115-volt, 60-cycle current supplied to many garages and service stations into direct current suitable for recharging automobile storage batteries, the General Electric Company, Schenectady, N. Y., has developed a type of "Tungar" rectifiers of 6 amperes, 75 volts capacity.

It will charge from one to ten three-cell storage batteries at a time. Tests of the device have proved its high efficiency, low operating costs, long life and marked ability to meet the various conditions of service. There are no moving parts and there is no fire risk.

A compensator with 15 taps is attached and a dial switch for adjusting the voltage according to the number of batteries to be charged. The current is instantly adjustable in steps up to six amperes. Simplicity is the keynote of construction and operation of the device, the general principle of which was described in our issue of December 23, 1916.

After the two upper wires are connected to the alternating-current supply and the direct-current leads coming out of the bottom of the rectifier are connected to the batteries, which should be connected in series, turning the alternating-current switch will start the rectifier charging without shaking. If the alternating current should fail, the batteries cannot discharge through the rectifier and will start recharging when the current comes on again.

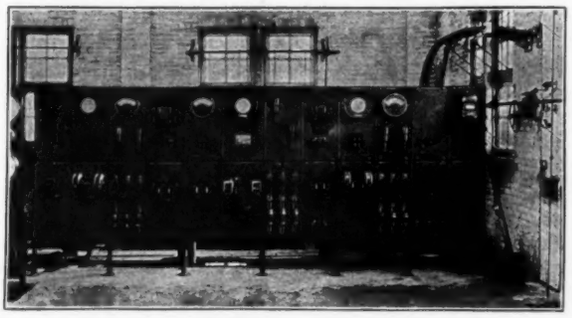
Charging costs about nine cents per three-cell battery for about a 13-hour charge when the batteries are charged in groups of ten, and about 12 cents per three-cell battery when they are charged in groups of five. The efficiency of the rectifier increases and recharging costs per battery are lowered as the number of batteries on charge is increased toward the 30-cell maximum capacity of this type of Tungar rectifier.

The entire apparatus including all live parts is inclosed in a perforated, japanned finish, sheet-iron casing.

Control Equipment for Electrically Operated Sewage Pumping Station.

A few months ago a new sewage pumping station was completed at Madison, Wis., which includes a considerable amount of electrical equipment of special interest. This station is known as the Greenbush sewage pumping station and contains three motor-driven pumps, all controlled from a board which consists of series of separate panels so as to amount almost to being four independent control boards. The plan of operation at the station is such that only one of the three pumps is in operation at any time under normal conditions. The three pumps are connected through a double Y-branch into a common discharge main provided with suitable valves.

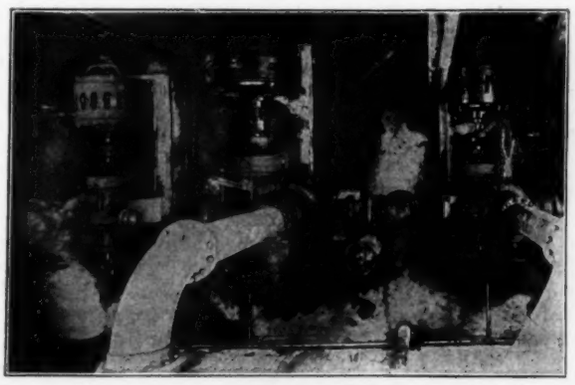
A general view of the control board is shown in one of the accompanying illustrations. The second illustration is a view looking down into the pump pit. On the control board the first unit board or panel controls the incoming alternating-current line. The second board controls a 65-horsepower motor direct-connected to a 3,000,000-gallon Allis-Chalmers double-suction centrifugal pump.



Control Board for Three Electrically Driven Pumps in the Greenbush Sewage Pumping Station, Madison, Wis.

The third board controls a 135-horsepower motor, which is direct-connected to a 4,500,000-gallon pump. The fourth unit of the board controls a 65-horsepower motor direct-connected to a 3,000,000-gallon pump similar to the first pumping unit referred to. To the right of the board can be seen a float switch which automatically starts and stops the pump which is connected for use. To the left of the switchboard is shown the recording instrument of the Venturi meter. All of the motors are of the alternating-current induction type and the control is of the magnetic type with control switches mounted along with the instruments and other apparatus on the board.

The entire installation was put in and is operated under the supervision of E. E. Parker, city engineer, Madison, Wis. All of the electrical control equipment installed was furnished by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.



View Looking Down into the Pump Pit of Sewage Pumping Station.

ACTIVITIES IN THE TRADE

Dielectric Manufacturing Company, St. Louis, Mo., has issued an interesting and useful 48-page booklet giving data on insulating materials.

W. R. Ostrander & Company, 371 Broadway, New York City, has prepared a bulletin descriptive of its new types of enameled-iron floor outlet boxes.

Railway and Industrial Engineering Company, Pittsburgh, Pa., has issued a bulletin on two new types of Burke horn-gap lightning arresters recently placed on the market.

American Engineering Company, Philadelphia, Pa., has prepared a bulletin on the "Taylor Power Dump," a quick-acting device for dumping ash and clinkers from boiler fires. It is used in connection with Taylor stokers.

The Crescent Insulated Wire & Cable Company, Taylor Street, Trenton, N. J., of which C. Edward Murray is president, has filed notice of increase in its capital stock from $250,000 to $1,000,000 for extensions to its plant.

Cooper Hewitt Electric Company recently held a salesmen's meeting at its factory in Hoboken, N. J. Representatives were present from the company's branch offices in Boston, Philadelphia, Pittsburgh, Cleveland, Detroit, St. Louis and Cincinnati.

Benjamin Electric Manufacturing Company, Chicago, Ill., is sending to the trade a mailing folder descriptive of Benjamin-Starrett stock panelboards. It should prove interesting to contractors who expect to do a big business during "Wire-Your-Home Time."

Dixie Device Corporation, 120 Liberty Street, New York, City, has purchased the electric vibrator business of the **Rubes Electric Devices, Incorporated,** Brooklyn, N. Y., and will market the same electromagnetic vibrator, which has already met with a cordial reception by the trade.

Spray Engineering Company, 93 Federal Street, Boston, Mass., has prepared bulletin No. 501, a condensed summarization of principal Spraco developments, which are water-cooling, air-washing and cooling equipment, sprinklers, flow-meters, nozzles and similar products.

Illinois Wire & Cable Company, Sycamore, Ill., has announced the establishment of a Chicago sales office in the Harris Trust Building, in charge of S. D. Binkowitz, who was for 16 years vice-president and secretary of the American Insulated Wire & Cable Company, of Chicago.

P. & B. Manufacturing Company, Milwaukee, Wis., has increased its capital stock from $25,000 to $50,000. This is in line with the policy of the company to increase its manufacturing activities. Along the same lines is the fact that the company is now building a new factory of thoroughly up-to-date type, which will be completed about May 1. A number of new electrical devices will probably be manufactured by the company and the present line of fittings will be extended. The officials of the company are H. E. Bloomer, president, and A. H. Peterson, secretary and treasurer.

Naugle Pole & Tie Company, Chicago, Ill., has prepared an attractive and instructive 24-page booklet valuable to anyone that buys poles. It comprises complete data on northern white cedar and western red cedar poles, including methods of butt treating and standard specifications for poles as given by the Northern White Cedar Association, Western Red Cedar Association, National Electric Light Association and American Telephone & Telegraph Company. Other serviceable information is given, and emphasis is placed on the excellent shipping facilities provided by Naugle service.

Hess-Bright Manufacturing Company, Philadelphia, Pa., has prepared a 32-page illustrated booklet giving examples and descriptions of the applications of ball bearings to machine tools.

Group Insurance Plan for Boston Employees of General Electric Company.—A plan for the group insurance of the 100 or more employees of the General Electric Company in its Boston office is being worked out through the office organization, the General Electric Association of Boston. The rate is based on the average age each year, and will be $10 to $11 per $1,000, the amount of the policy being based on the salary.

Lux Manufacturing Company, Hoboken, N. J., has announced the production of a line of 27 to 32-volt nitrogen-filled lamps, these being manufactured in 25, 50, 75, 100, 150 and 200-watt sizes. Tests have shown them to be very durable lamps of excellent efficiency. Manufacturers of low-voltage electric plants probably will welcome this addition to lamp developments which will permit of more outlets to be used in conjunction with their plants. A number of railroad companies are considering the equipment of coaches with this type of lamps, which will be ideal for train-lighting service.

Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, has issued bulletin No. 41,514 on type BSS varying-speed single-phase motors. These are of the repulsion type, the speed variation being obtained by shifting the brushes. They are made in sizes of one-sixth to 7.5 horsepower, 1,200 and 1,800 revolutions per minute, 25, 40, 50 and 60 cycles, 110 and 220 volts, and are suitable for drives where speed variation is required with nearly constant torque, such as small printing presses. Hand, foot and push-button controls have been developed for these motors. A new booklet on electric fans has also been issued by the Sprague company.

New Company Organized for Manufacture of Flashlight Batteries.—Owing to the great demand for dry batteries for flashlights during the war period, the Astra Electric Novelty Works, Incorporated, has been formed to further this business in America as well as in foreign countries. The offices of the new company are at 45 East Seventeenth Street, New York City. The factory, at 152-156 Wooster Street, is equipped with the most modern machinery and its capacity enables the handling of large orders for early delivery. The laboratory connected with the factory is equipped with every up-to-date device for testing and experimental purposes. Territorial agencies are being allotted by the new concern.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has begun an elaborate campaign for placing its new sewing-machine motor—the Westinghouse Sew-Motor—on the market. The campaign has as its primary object to induce the prospective user of a sewing-machine motor to go to his or her electrical dealer and purchase the Sew-Motor. To assist the dealer in taking advantage of the demand which has been created, an extensive series of selling helps has been provided to tie up with the national advertising done by the company. The dealer helps include an eight-page mailing folder for distribution to prospective customers, cuts for dealer advertisements, street-car advertising cards, lantern slides, and window display materials consisting of an elaborate lithographed cutout and display cards.

PERSONAL AND BIOGRAPHICAL

MR. E. R. TREVERTON, who has for the past ten years been identified with the lighting industry, has become a general "all 'round" man for the Holophane Glass Company, Incorporated, with offices at 340 Madison Avenue, New York City. The association is especially significant as the Holophane company is known for its progressive spirit along the lines of the scientific, as well as artistic development in lighting. Mr. Treverton possesses a broad knowledge of engineering and trade conditions in the field as well as a wide acquaintance with those prominent in the work. For three years Mr. Treverton was managing editor of the *Lighting Journal*, and his work as a writer, and also as a speaker, has been recognized as singularly direct and clear. Mr. Treverton is a graduate of Lehigh University. After getting a fundamental

E. R. Treverton.

training in central-station work with the cadet school in the Doherty organization at Denver, he joined the engineering department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., being engaged in designing and engineering for its various shops the first really scientific industrial lighting system in this country. From 1910 for three years he was with the illuminating engineering department of the Westinghouse Lamp Company, later becoming chief engineer of that department.

MR. GEORGE W. LANGDON, a civil engineer of Newburyport, Mass., has been engaged by the Newburyport Gas & Electric Company to make surveys and plans showing locations of poles, wires, lamps, street mains, drops, valves, etc., in Newburyport, Newbury and West Newbury.

MR. PETER JUNKERSFELD, assistant to the vice-president, Commonwealth Edison Company, Chicago, has been commissioned a major in the Engineers' Officers Reserve Corps, United States Army, and appointed to the examining board for the Chicago-Milwaukee district, which will consider applications of technically trained for enlistment in the corps, a volunteer branch of the army.

MR. H. C. HOAGLAND has been appointed vice-president and general manager of the Central Oklahoma Light & Power Company, with temporary offices in the Skirvin Hotel, Oklahoma City.

MR. KENNETH LINDSAY, manager of the Wapsie Power & Light Company, at Mt. Vernon, Iowa, has resigned, effective April 15, to become sales manager of the J. B. Terry Company, electrical jobber, Cedar Rapids, Iowa.

MR. J. F. OWENS has been appointed manager of the Muskogee (Okla.) Gas & Electric Company, with MR. W. R. EMERSON assistant manager, and MR. L. A. WHITE assistant general superintendent.

MR. A. H. FORD, vice-president and general manager of the Cumberland County Power & Light Company, which operates the traction system as well as the central-station business in Portland, Me., has been chosen president of the New England Street Railway Club.

MR. GEORGE R. SHELDON has been elected chairman of the board of directors of the North American Company, of New York City, owner of a number of electric-lighting companies, to succeed the late James Campbell. MR. HENRY H. PIERCE was chosen treasurer to succeed Mr. Sheldon.

MR. L. P. HAMMOND and MR. L. H. HEINKE were elected members of the board of directors of the United Light & Railways Company, Grand Rapids, Mich., at the annual meeting of the stockholders. Mr. Hammond was at one time manager of the Colorado Power Company, and lately has been connected with the banking firm of William P. Bonbright & Company, New York City. Mr. Heinke formerly was secretary of the United company.

MR. L. R. W. ALLISON, for a number of years past associated with the Rice Electric Display Company, of New York City, in advertising, sales, promotion and managerial capacities in connection with its affiliated organization known as the Rice Leaders of the World Association, has resigned, effective April 1, to engage independently in electrical and technical writing and research work at Newark, N. J. Mr. Allison was formerly located at Los Angeles, Cal., and has been a frequent contributor to the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

MR. W. A. LAYMAN, president of the Wagner Electric Manufacturing Company, St. Louis, Mo., has been called to Washington for a special conference, to be held April 2, of the chairmen of business committees organized by the Chamber of Commerce of the United States to work in connection with the Council of National Defense. Committees for the different cities and districts were appointed at the instance of Secretary of War Baker and will co-operate with army district depot quartermasters in the purchasing of supplies. Mr. Layman is chairman of the St. Louis committee.

MR. C. W. FORBRICH, western manager of ELECTRICAL REVIEW AND WESTERN ELECTRICIAN since 1908, has resigned his position to enter the advertising field on his own account, a plan which he has had maturing for sime time. Mr. Forbrich is probably the oldest electrical newspaper advertising man, in point of service, having been in the business since March, 1888. He began as the first office boy of the WESTERN ELECTRICIAN, and was secretary and treasurer of that publication for a number of years prior to its consolidation with the ELECTRICAL REVIEW in 1908. His many friends in the Central and Western states will doubtless be interested to learn that he will continue to be identified with the electrical business as he has formed the Forbrich-Burton Advertising Service, Inc., Monadnock Block, Chicago, whose object will be to

C. W. Forbrich.

give selling co-operation; to place trade-paper and magazine advertising, and design and write advertising literature of all kinds for electrical, mechanical and other manufacturers. Mr. Forbrich's associate, J. H. Burton, who was also formerly connected with the WESTERN ELECTRICIAN, is well versed in creative advertising, and for the past few years has had charge of the service department of *Practical Engineer*. Messrs. Forbrich and Burton's combined experience of nearly 40 years in advertising should fit them to render very valuable service to their clients. While deeply regretting the loss of Mr. Forbrich as a member of the organization, his former associates unite in wishing him continued success.

OBITUARY.

MR. MAYR ARONSON, member of the firm of Shapiro & Aronson, manufacturers of lighting fixtures, New York City, died March 12, at his home in that city.

MR. EDGAR B. WARD, East Orange, N. J., a director of the Public Service Corporation, died March 17 of intestinal trouble, aged 68 years. Mr. Ward was a prominent citizen of that section, and formerly second vice-president of the Prudential Insurance Company, Newark, N. J.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

AUGUSTA, ME.—The Public Utilities Commission has approved an issue of $30,000 of stock by the Vassalboro, China & Windsor Light & Power Company. Water-power rights have been secured on Seaward's mill stream, which when developed will produce about 110 horsepower. About $60,500 will probably be spent for development and for a distribution system.

GARDNER, ME.—The Lewiston, Augusta & Waterville Street Railway plans to expend about $200,000 this year for added power facilities. Engineers are now inspecting the situation.

YARMOUTH, ME.—The city has been granted permission to purchase the franchise and plant of the Yarmouth Lighting Company.

MONTPELIER, VT.—A large amount of construction is under way on the hydro-electric plants of the Vermont & Quebec Power Company at Stevens Mills and Granby, P. Q. The company is soon to furnish 1,200 electric horsepower to the United States Crysotile Asbestos Company, Inc., New York, operators of talc mines in Eden and Lowell, Vt. The power company has a 600-kilowatt generator in operation at Stevens Mills and another is to be put in operation the last of March. R. R. Livingston, of New York, is engineer for the talc company and also of the power company.

ADAMS, MASS.—A transmission line is being built to supply electricity to the Adams Woolen Company. Motor drives are being installed in the mill.

BROCKTON, MASS.—Plans are being made for a white way in the local business district, which are being considered by A. F. Nelson, local manager of the Edison Electric Illuminating Company.

BOSTON, MASS.—The Legislative Committee on Public Lighting has reported a bill to enable the Gas and Electric Light Commission to determine price and conditions, if parties cannot agree, when a municipality votes to take a municipal water supply.

NORTHBORO, MASS.—A committee appointed to consider public lighting is negotiating with the Marlboro Electric Light Company for the renewal of the street-lighting contract, which expires July 18. A municipal plant will be considered.

SALEM, MASS.—A second 6,250-kilowatt, 60-cycle, 2,300-volt General Electric turbo-generator is about to be installed in the station of the Salem Electric Lighting Company. Foundations of solid concrete were put in some months ago. When this unit has been installed the station will have a rated capacity of 17,000 kilowatts. In 1909, when the plant was acquired by Charles H. Tenney & Company, of Boston, the capacity was 2,000 kilowatts. A Westinghouse jet condenser will be installed directly beneath the turbine. A concrete canal from South River is being constructed as a means of supplying condensing water. Two sets of screens are to be installed to prevent debris passing.

BRIDGEPORT, CONN.—The United Illuminating Company is planning to extend its lines in the town of Trumbull.

EAST BERLIN, CONN.—Electrical contractors have been canvassing this place to secure the wiring of residences.

FARMINGTON, CONN.—The pressure on the line from the Farmington River Power Company's station here to the Stanley Works in New Britain, has been raised to 22,000 volts with successful results.

PUTNAM, CONN.—The Putnam Light & Power Company has been authorized to increase its capital stock to $110,000.

WALLINGFORD, CONN.—The United Electric Light & Water Company, of Waterbury, proposes to construct a line of transmission towers through this region. An increase in capitalization of $3,000,000 has been asked for of the state authorities.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company will erect a transmission line along the New London turnpike.

TROY, N. Y.—The Public Service Commission is considering the application of residents of the territory between the Troy city line at Albia and Wynantskill for the installation and operation of a local electric system, with service to be furnished by the Wynantskill Hydroelectric Company.

ELIZABETH, N. J.—The Board of Works has awarded a one-year contract for lighting to the Elizabethtown Gaslight Company. At the end of this period it is expected to have plans perfected for the installation of a municipal electric plant.

TRENTON, N. J.—The City Commission will receive bids until April 4 for furnishing and installing a conduit and cable system in Mahlon Stacy Park, for the operation of a lighting system. Leon D. Hirsch is city clerk.

TRENTON, N. J.—The Legislature is considering a bill to provide for the establishment of an improved street-lighting system, to form a white way in the business section of Trenton, including Broad and Warren Streets. Plans have been prepared by the City Commission for lamp and conduit locations.

WOODRIDGE, N. J.—The Public Service Electric Company has been awarded a contract for street lighting. The company has also tendered the only bid for lighting in North Bergen Township, and will receive the contract for this district.

ALLENTOWN, PA.—The Lawrence Portland Cement Company is installing electric equipment at its Siegfried cement plant, which has a capacity of about 5,000 barrels per day. All steam-driven equipment will be replaced by electric operation, with power furnished by the Lehigh Navigation Electric Company. The improvement is estimated to cost $250,000.

CONEMAUGH, PA.—Plans are being prepared for electrifying the Pittsburgh division of the Pennsylvania Railroad, from Conemaugh to Altoona, a distance of 35 miles. Alexander C. Shand, Philadelphia, is chief engineer.

GETTYSBURG, PA.—The Town Council is considering the installation of a new fire-alarm system.

HARRISBURG, PA.—The City Council has commenced the installation of new arc lamps at street intersections along Front Street.

HARRISBURG, PA.—The city has appropriated $2,500 for placing police and fire alarm wiring underground. The work will be in charge of City Electrician C. E. Diehl.

HARRISBURG, PA.—The Public Service Commission has received applications from the following electric companies for permission to issue bonds in amounts noted for improvements and extensions in their plants and systems: Penn Public Service Company, Philadelphia, $338,000; Lehigh Valley Transit Company, Allentown, $135,000; Berkshire Electric Company, Lancaster, $45,000; Penn Central Light & Power Company, Altoona, $120,000; Pennsylvania Hydroelectric Company, Altoona, $36,000; Pennsylvania Utilities Company, Easton, $46,000; Pennsylvania Power Company, Ellwood City, $10,000; New Castle Electric Company, New Castle, $9,000, and the West Penn Railways Company, Pittsburgh, $45,000.

HAZLETON, PA.—The Lehigh Valley Coal & Navigation Company is substituting electric operation for steam power at its Cranberry mines at a cost of about $300,000. New electric pumping equipment is now being installed.

JOHNSTOWN, PA.—Negotiations are being made between the City Council and Superintendent P. J. Morrissey, of the Citizens Light, Heat & Power Company, for the installation of a white way in the business district.

PHILADELPHIA, PA.—F. A. Poth & Company will build a one-story boiler plant at their brewery, Thirty-first and Jefferson Streets, to cost about $30,000.

READING, PA.—The Carpenter Steel Company has commenced the installation of two new six-ton electric furnaces.

SCRANTON, PA.—The Scranton & Binghamton Railway contemplates the erection of a 66-volt electric transmission line from the present terminal in Tiany to Binghamton during the present year.

BALTIMORE, MD.—A plan for lighting alleys with electricity without the expense of laying conduits was outlined at a recent meeting of the Municipal Electrical Commission. It consists of the use of overhead poles in connection with automatic switches and was submitted by the Consolidated Gas & Electric Company. The scheme would save the city between $200,000 and $300,000, the cost of laying municipal conduits in alleys. Consideration is to be given the plan, which has the approval of Calvin W. Hendrick, chief engineer of the city.

HAGERSTOWN, MD.—Improvements involving the expenditure of from $150,000 to $200,000 in generating equipment are contemplated by the Potomac Light & Power Company, of Martinsburg, of which the Hagerstown & Frederick Railway Company holds the controlling interest. Emory L. Coblentz, of Middletown, is president of the Potomac company.

ETTRICKS, VA.—The City Council is planning ways and means to secure a municipal electric-lighting plant.

FAIRMONT, W. VA.—The Kanawha Traction & Electric Company and the Monongahela Valley Traction Company, of this city, have concluded an arrangement whereby the latter will take over the property of the Kanawha company, the deal involving about $4,000,000. The Kanawha company comprises a system of street railways, electric lighting, power plants and interurban railways in West Virginia and Ohio.

PRINCETON, W. V.—The Athens Power Company has been incorporated with a capital of $10,000, by J. N. Hoylman, F. A. Bohn and others, to furnish electric service in this vicinity.

SPRING HOPE, N. C.—J. B. Privette is organizing a company to build a hydroelectric plant and develop the Webb Mills waterpower site near this city.

UNADILLA, GA.—The City Council has decided to build an electric-lighting plant to cost about $10,000.

FELLSMERE, FLA.—The City Council contemplates the erection of an electric-lighting plant. A 50-horsepower oil engine probably will be installed. G. E. King is in charge of the plans.

WAUCHULA, FLA.—The Wauchula Light & Power Company contemplates the installation of two 100-kilowatt, 2,300-volt, 60-cycle generators, direct connected to high-speed engines. E. L. Dunn is general manager of the company.

NORTH CENTRAL STATES.

ASHLEY, O.—The Ashley Electric Light & Power Company has been organized by C. F. Sperry, J. B. Johnston and others, to serve this community. The capitalization is $10,000.

CHILLICOTHE, O.—The Hillsboro, Cynthiana, Bainbridge & Chillicothe Traction Company plans to construct an electric line from here to Hillsboro.

STEUBENVILLE, O.—F. A. Boutelle, J. B. McCullough and others have incorporated the Buckeye Power Co. with a capital of $9,000, and will furnish electric service in this vicinity.

INDIANAPOLIS, IND.—Construction will begin soon on the new power plant to be erected by the Indianapolis Light & Heat Company on part of the site of its present plant in Kentucky Avenue. The building, which will be 200 by 100 feet, will cost approximately $200,000, and will be completed by October 1. When the building now planned has been finished the present house will be torn down and the second half of the proposed plant will be constructed. The new building will house equipment sufficient to maintain two 30,000-horsepower units.

SOUTH BEND, IND.—A petition has been presented to the City Council for the improved electric lighting on the Colfax Avenue and La Salle Avenue bridges.

WARSAW, IND.—The City Council has appointed a committee to secure estimates for a new lighting system.

FARINA, ILL.—The Farina Electric Light Company has been incorporatel with a capital of $2,500 by Dan McCormick and others, and will supply electric service here.

SPRINGFIELD, ILL.—The North End Improvement Association has petitioned for improvements in the electric-lighting system.

LANSING, MICH.—The Commonwealth Power, Railway & Light Company, which operates the Consumers Power Company, the Michigan Railway Company, and the Michigan Light Company, will spend more than $10,000,000 in Michigan this year, according to H. H. Crowell, Michigan representative of the corporations. The corporation is working on about 50,000 additional horsepower capacity to its present water power plants, of which about 30,000 will be on the Au Sable and 20,000 on the Manistee. Approximately 30,000 horsepower will be added to the corporations' steam plants in Battle Creek and Grand Rapids.

MASON, MICH.—The Consumers Power Company has petitioned for a franchise to furnish electric service here.

GRAND RAPIDS, WIS.—The City Council is planning to install an ornamental electric-lighting system here.

GREEN BAY, WIS.—The Wisconsin Railroad Commission has issued a certificate of convenience and necessity to the Green Bay Eastern Railway, which proposes to construct an electric line connecting Green Bay with Manitowoc and Sheboygan, Wis. Construction plans will be rushed and actual building operations may be started early in the summer.

MAIDEN ROCK, WIS.—The Wisconsin-Minnesota Light & Power Company is planning to begin construction work on a transmission line to Plum City and Maiden Rock in order to furnish energy for street lighting and private consumption.

SHEBOYGAN, WIS.—The erection of a new power house of 5,000 or 6,000 kilowatts capacity here is embodied in the plans of the Eastern Wisconsin Electric Company, according to Raymond H. Smith, general manager. This power plant will be connected with the Fond du Lac and Oshkosh properties of the company by a transmission line. The plant will be a steam unit, and plans for its erection will be completed soon.

WATERTOWN, WIS.—The Wisconsin Gas & Electric Company has completed a transmission line between this city and Clyman and Reesville, and service is being supplied in those municipalities, as well as to farmers near the line. The company recently acquired the electric plant in the village of Marshall.

ROCHESTER, MINN.—The City Council is receiving bids for the construction of a hydroelectric power plant on the Zumbrota River. Separate bids for masonry, hydraulic turbines, cement and electric machinery are being made.

RUTHTON, MINN.—Bonds in the sum of $4,000 have been issued, the proceeds to be used for a local electric-lighting system.

CLERMONT, IOWA.—C. C. Miller & Sons, proprietors of the Turkey River Power Company, of Clermont, have completed a transmission line through the towns of Wadena and Arlington, to Volga City, and are supplying 24-hour service. The Volga City power plant has been purchased, and improvements will be made.

MOUNT AYR, IOWA.—The Mount Ayr Electric Company contemplates extending its lines, to furnish electricity to the towns of Maloy and Benton.

PISGAH, IOWA.—Citizens here have voted to issue $14,000 in bonds to improve the electric-lighting and water plants.

WEST LIBERTY, IOWA.—The Iowa Light & Power Company, of Cedar Rapids, will erect a transmission line from Cedar Rapids to West Liberty.

PECULIAR, MO.—L. K. Green & Sons, of Pleasant Hill, Mo., has petitioned the City Council for a franchise to supply electric service.

ST. JOSEPH, MO.—That a bond issue of $165,000 for the city electric plant will be sufficient is the opinion of C. D. Fox, superintendent of the city plant. It was explained that a complete remodeling of the plant must be made, that the present equipment was worthless, and that no salvage could be obtained, save the building and the lot upon which it stands. It was stated that the white way system could be bought from the street railway company at a rate of about $75 a post. The total amount necessary for this purpose included $19,275 for the purchase of the posts and an additional $25,200 for transformers and equipment.

BALDWIN, KANS.—The city may vote $20,000 in bonds to pay for improvements to the electric-lighting plant and waterworks system.

CAWKER CITY, KANS.—A white-way system probably will be installed here.

ELLIS, KANS.—About $10,000 will be expended for extensions and improvements to the municipal electric-lighting plant.

HIGHLAND, KANS.—When the Hiawatha Light Company extends its transmission line from Robinson to Highland, the towns of Leona and Severance will be included. The line will branch off at Bellevue to Leona, and from there be extended to Severance. It is probable that White Cloud will ask for electric service from Hiawatha.

INDEPENDENCE, KANS.—The City Council has called an election April 3 to vote on the issuance of $70,000 in bonds for the erection of a municipal electric plant.

PALCO, KANS.—A municipal electric-lighting plant may be established here.

VALLEY FALLS, KANS.—The local electric light and power plant has been sold to Mexley & Company.

RAVENNA, NEB.—The Central Power Company, which owns a power plant near Boelus, has purchased the local electric light and power plant, and will operate it in conjunction with the Loup River plant as soon as necessary changes and connections can be made.

CANBY, S. D.—A franchise has been granted to the Citizens Light, Heat & Power Company to construct transmission lines to Hendricks, Minn. Emil W. Erick is general manager of the company.

GETTYSBURG, S. D.—Plans are being considered for the establishment of an electric light and power plant. A proposition has been submitted by Hugh Triplett, consulting engineer, of Aberdeen, S. D.

IROQUOIS, S. D.—The local electric-lighting plant will be improved by the installation of a gas engine, generator and other machinery. W. L. Jordan is manager.

BISMARCK, N. D.—Bids are being received for the installation of ornamental electric-lighting units on several streets of the city.

DATES AHEAD.

Tri-State Water and Light Association of the Carolinas and Georgia. Annual convention, Macon, Ga., April 17-19. Secretary, W. F. Steiglitz, Columbia, S. C.

Southwestern Electrical and Gas Association. Annual convention, Dallas, Tex., April 26-28. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

National Fire Protection Association. Annual meeting, Washington, D. C., May 8-10. Secretary-treasurer, Franklin H. Wentworth, 87 Milk Street, Boston, Mass.

Arkansas Association of Public Utility Operators. Annual convention, Pine Bluff, May 16-18. Secretary-treasurer, R. B. Fowles, Pine Bluff Company, Pine Bluff, Ark.

Missouri Association of Public Utilities. Annual convention, aboard Steamer *Quincy* en route from St. Louis, May 17-19. Secretary, F. D. Beardslee, 315 North Twelfth Street, St. Louis, Mo.

Electrical Supply Jobbers' Associations. Semi-annual meeting, Homestead Hotel, Hot Springs, Va., May 23-24. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

Iowa Section, National Electric Light Association. Annual convention, Des Moines, Iowa, May 24-25. Secretary, L. E. Caldwell, Iowa City, Iowa.

National Electric Light Association. Annual convention, Atlantic City, N. J., May 29-June 1. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York City.

American Institute of Electrical Engineers. Annual convention, Hot Springs, Va., June 26-29. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York City.

SOUTH CENTRAL STATES.

BARBOURVILLE, KY.—The Barbourville Electric Light, Heat & Power Company is making a survey of the village of Artemus, near here, with a view to erecting a transmission line to that point and supplying the community with electricity.

BERRY, KY.—M. R. Bowman is constructing an electric-lighting plant to supply the community, to cost about $6,000.

LEXINGTON, KY.—The Kentucky Utilities Company has let a contract for an addition to its power plant. A 4,000-kilowatt generator will be installed. The total cost of the improvements will be about $125,000.

LEXINGTON, KY.—Work will begin immediately on the installation of a white-way system on five blocks of Main Street. In connection with construction of the conduit system for this service the telephone and telegraph and lighting wires will be removed from the same section. The white-way lamps will be of 1,000 candlepower each.

SPRINGFIELD, KY.—The Springfield Water & Electric Light Company will build a new brick office building on Main Street, to cost $3,500.

MILLINGTON, TENN.—The Millington Light & Water Works Company will make extensive improvements and build a transmission line to furnish light to two small nearby towns. W. C. Hill is manager of the company.

KENNER, LA.—Proposals will be received by the City Council until April 9 for lighting Kenner with electricity and the furnishing of electric light and power for commercial, residential and other purposes.

LITTLE ROCK, ARK.—John W. Bleidt, superintendent of the municipal electric-lighting plant, recommends the purchase of additional machinery. The specifications include a 500-horsepower boiler.

BEARDEN, ARK.—The City Council has granted a franchise to the Bearden Electric Light Company, which will erect a plant here soon.

FREDERICK, OKLA.—A bond issue of $35,000 has been voted, the proceeds to be used for buying and improving the local electric light and power plant.

SKIATOOK, OKLA.—The question of issuing $12,000 electric bonds will be submitted to the people.

HOUSTON, TEX.—The Intermountain Railway, Light & Power Company, of Colorado Springs, Colo., has secured permission to operate in Texas. It will maintain headquarters in this city and will operate in Navasota, Sour Lake and Silsbee.

SAN ANTONIO, TEX.—A proposal for an electric light and power franchise is to be submitted to the City Commission by C. H. Alexander, owner of a hydroelectric at the Marble Falls dam across the Colorado River.

WESTERN STATES.

MISSOULA, MONT.—The Missoula Light & Power Company has entered into negotiations with the City Council for a new street-lighting contract.

OSWEGO, MONT.—The City Council is planning to install a municipal electric-light plant.

POPLAR, MONT.—The Miracle Engineering Company has petitioned for a franchise to construct a heating and power plant here.

HANOVER, N. M.—Fire recently destroyed the mill and power plant of the Hanover Bessemer Iron & Copper Company. The establishment was completed only a short time ago. The loss is estimated at $100,000.

GALLUP, N. M.—George A. Keepers has been granted a franchise by the Board of Trustees to furnish electricity for power, heat and illuminating purposes to the citizens of Gallup for a period of 25 years. He will build a power plant.

CLARKDALE, ARIZ.—The Steam Generating Company has been granted permission by the Corporation Commission to erect a steam electric plant at Clarkdale and to lease the plant to the Arizona Power Company.

GLOBE, ARIZ.—The Salt River Valley Water Users' Association plans to construct a hydroelectric plant at Horse Shoe Bend on Salt River, about 20 miles below the Roosevelt dam. The proposed plant will develop about 10,000 horsepower. This organization also has in view the construction of a dam across the Verde River at a point about 80 miles above the stream's junction with Salt River and the building of a system of irrigation canals and ditches with a view of reclaiming about 40,000 acres of land. This project will involve the expenditure of about $1,000,000.

PEACH SPRINGS, ARIZ.—Preliminary surveys looking to the construction of four large dams across the Diamond and other lateral canyons of the Grand Canyon of the Colorado near here and the installation

of a series of hydroelectric plants are now being made by engineers, under the direction of the W. L. Clark Construction Company, of New York. It is stated that financial interests that are connected with the Atchison, Topeka & Santa Fe are back of this power project. The plans involve the construction of a system of electric power transmission lines that will run to many of the cities, towns and mining camps of Arizona. It is not improbable, it is stated, that one or more divisions of the Santa Fe Railroad will be operated by energy to be obtained from this source.

PHOENIX, ARIZ.—An election will be held soon to vote $120,000 in bonds to provide funds for the installation of an ornamental lighting system and other municipal work.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company will build transformer vaults under Main Street, between Second and Third South Streets, and an electric house service circuit will be installed between Ninth South and South Temple Streets east of Second East. The proposed improvements will cost about $50,000.

BOISE, IDAHO.—The Washington Water Power Company has been given permission to construct a transmission line near Wallace.

KENDRICK, IDAHO.—A special election will be held April 14 to vote bonds for the buying of the Potlatch water and power system.

TACOMA, WASH.—The Tacoma Railway & Power Company is seeking a franchise for the extension of its lines through Thurston County to furnish electric light and power and electric-railway service in that district.

PORTLAND, ORE.—The Portland Railway, Light & Power Company is investigating the advisability of extending the Willamette Valley Southern Railway from Mount Angel to Silverton, at a cost of about $120,000.

ARCADIA, CAL.—Bids are being received by the Board of Trustees for installing 29 reinforced-concrete ornamental street-lighting standards with equipment on First Avenue.

AUBURN, CAL.—The citizens of the Gold Hill district have united with the Mount Pleasant district in building a new pole line from the Mulligan place to Lincoln.

COLUSA, CAL.—The Northern California Power Company has been instructed by the Board of Supervisors to install street lights on certain streets in the Williams lighting district.

FALLBROOK, CAL.—The San Diego Consolidated Gas & Electric Company has been granted the contract to install a lighting system in the Fallbrook lighting district.

FRESNO, CAL.—The Board of Supervisors has awarded the contract for establishing the Caruthers lighting district to the San Joaquin Light & Power Corporation. The system will be installed soon. The contract will run five years.

LOS ANGELES, CAL.—The Board of Supervisors has ordered repairs and replacements of equipment in the Bonita Meadows lighting district.

LOS ANGELES, CAL.—The Board of Trustees has ordered the installation of necessary appliances and the furnishing of electrical energy for lighting Beacon Street between Fourth and Sixth Streets.

LOS ANGELES, CAL.—A telephone switchboard and electric-lighting fixtures are included in a $51,500 appropriation made by the Board of Education for improvements and equipment for the Los Angeles High School.

LOS ANGELES, CAL.—The Pacific Electric Railroad Company has been granted a franchise by the County Supervisors to use certain streets and highways in the county on which to operate a street railway system. The franchise runs for 40 years.

MARYSVILLE, CAL.—A street-lighting system will be installed in Marysville at a cost of $2,500. Plans are completed and the construction work will start at an early date.

OROVILLE, CAL.—The Great Western Power Company has begun work on an extension of its power lines along the north fork of the Feather River.

SALINAS, CAL.—The committee appointed by the City Council to investigate the city lighting question reports that a lighting system and small substation can be installed at a cost of $12,868.

SAN FRANCISCO, CAL.—Bids are being received by the Board of Public Works for furnishing and delivering electric line transformers for the lower Cherry River development.

SAN FRANCISCO, CAL.—Bids are being received by the Board of Public Works for furnishing and delivering electric cables and splicing materials for use in the municipal railway system.

SAN MATEO, CAL.—This city will install 47 single-globe electroliers, each containing high-power Mazda lamps, in the business district.

WATTS, CAL.—The California-Arizona Construction Company has secured the contract for the installation and equipment of ornamental electroliers on Melvin Avenue from Shorb Avenue to Main Street. Their bid was $60 a post.

SEWARD, ALASKA.—Linemen recently completed the installation of a telephone and telegraph line across a section of swamp in Susitna Valley. This swamp is impassable in the summer, and the linemen doing the work were forced to wear snowshoes. The new extension opens communication from Seward to the Talkeetan River, a distance of 245 miles. The northern end of the line is located at Dead Horse Hill, which is about half the distance from Seward to Fairbanks.

New Publication

BRIEF FOR MUSCLE SHOALS NITRATE PLANT.—A brief for the establishment of a government nitrate plant at Muscle Shoals in the Tennessee River has been prepared by a committee of the Nashville Section of the Engineering Association of the South, of which John Howe Peyton, president of the Nashville, Chattanooga & St. Louis Railway, is chairman, and is a concise presentation of data obtained by a thorough investigation into the question from every angle. More than half the 64-page book is made up of photographs illustrating the conditions of the site, maps that show locations and charts that explain conditions graphically. The book is published for the dual purpose of informing the business men of the country concerning the project and explaining to the government officials why the plant should be placed at Muscle Shoals. It is one of the most interesting records of the country's resources that has ever been prepared.

Financial Notes

A special meeting of stockholders of the Western Electric Company, Incorporated, has been called for April 3 to vote on the question of increasing the capital stock from $15,000,000 to $30,000,000.

The Philadelphia Electric Company, Philadelphia, Pa., has recorded a mortgage of $60,000, covering an authorized bond issue of the same amount, of which $35,000,000 will be issued at the present time.

The Southern California Edison Company, Los Angeles, Cal., has filed application for authority to issue 50,000 shares of its common capital stock of a par value of $100 each. This proposed stock issue concerns the planned merger of this company with the Pacific Light & Power Corporation.

Reports of Earnings.

DAYTON POWER & LIGHT.

	1917	1916
February gross earnings	$167,246	$132,690
Operating expenses	113,378	67,071
Net earnings	53,868	65,619
Non-operating revenue	687	239
Total income	54,555	65,858
Interest on bonds	15,204	15,287
Other interest and sinking fund	10,203	1,678
Total deductions	25,407	16,965
Net income	29,148	48,893
Dividend on pfd. stock	14,813	14,813
Surplus	14,335	34,080

NORTHERN STATES POWER.

Gross earnings of the Northern States Power Company in 1916 increased 18.8 per cent over 1915, and net increased 16.5 per cent. After deducting depreciation, the year's proportion of debt, discount and expense, and preferred dividends, the balance available for dividends on the $5,975,000 common stock was $463,292, equal to 7.75 per cent. The income account compares as follows:

	1916	1915
Gross earnings	$6,087,158	$5,121,826
Net earnings	3,341,656	2,866,634
Fixed charges	1,593,127	1,507,939
Preferred dividends	740,236	587,069
Balance	1,008,292	771,625

An initial distribution on the common stock was made for the quarter ended June

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

	Div. Rate Per cent	Bid Mar. 19	Bid Mar. 26
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	....	24	26
Adirondack Electric Power of Glens Falls, preferred	6	80	83
American Gas & Electric of New York, common	10+extra	135	138
American Gas & Electric of New York, preferred	6	51	50
American Light & Traction of New York, common	....	355	358
American Light & Traction of New York, preferred	6	111	112
American Power & Light of New York, common	4	84	84
American Power & Light of New York, preferred	6	91	90
American Public Utilities of Grand Rapids, common	....	35	35
American Public Utilities of Grand Rapids, preferred	6	71	69
American Telephone & Telegraph of New York	....	127¼	127¼
American Water Works & Elec. of New York, common	....	13	12½
American Water Works & Elec. of New York, particip	7	35	33
American Water Works & Elec. of New York, first preferred	....	85	83
Appalachian Power of Bluefield, common	....	6	6½
Appalachian Power of Bluefield, preferred	7	37	37
Cities Service of New York, common	6+extra	292	293
Cities Service of New York, preferred	6	89	90
Commonwealth Edison of Chicago	8	134½	136½
Comm. Power, Railway & Light of Jackson, common	4	57	57
Comm. Power, Railway & Light of Jackson, preferred	6	80	80
Federal Light & Traction of New York, common	....	14	14
Federal Light & Traction of New York, preferred	....	51	50
Illinois Northern Utilities of Dixon	6	81	80
Middle West Utilities of Chicago, common	2+2 extra	58	58
Middle West Utilities of Chicago, preferred	6	78	77½
Northern States Power of Chicago, common	7	100	99
Northern States Power of Chicago, preferred	7	99	98
Pacific Gas & Electric of San Francisco, common	5	64¾	66
Pacific Gas & Electric of San Francisco, preferred	6	93	92½
Public Service of Northern Illinois, Chicago, Common	7	109	109
Public Service of Northern Illinois, Chicago, preferred	6	100	101¾
Republic Railway & Light of Youngstown, common	4	40	41
Republic Railway & Light of Youngstown, preferred	6	72½	71
Standard Gas & Electric of Chicago, common	....	13	12¾
Standard Gas & Electric of Chicago, preferred	6	39½	39½
Tennessee Railway, Light & Power of Chattanooga, common	....	8	7
Tennessee Railway, Light & Power of Chattanooga, preferred	6	38	34
United Light & Railways of Grand Rapids, common	4	47	46
United Light & Railways of Grand Rapids, preferred	6	76	75
Western Power of San Francisco, common	....	17	16½
Western Power of San Francisco, preferred	6	65	63
Western Union Telegraph of New York	5+extra	94⅞	96
Industrials—			
Electric Storage Battery of Philadelphia, common	4	65	65
General Electric of Schenectady	8	164	165
National Carbon of Cleveland, common	8	†300	†300
National Carbon of Cleveland, preferred	7	†132	†135
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	50⅞	50¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	†69	†71

† Last Sale.

30, 1916, of 1½ per cent. This rate was increased for the quarter ended Dec. 31 to a 7 per cent per annum basis.

MARCONI WIRELESS TELEGRAPH.

The Marconi Wireless Telegraph Company of America has issued a report for the year ending December 31, 1916. Comparative figures for 1916 and 1915 are as follows:

	1916	1915
Gross earnings	$756,572	$748,238
Royalties	3,428	43,700
Operating expense	631,530	520,475
Net earnings	121,614	184,061
Income from investment of surplus funds	150,274	104,933
Deductions	122,011	111,678
Net income	149,877	177,316

Incorporations

PORTLAND, ORE.—Stubbs Electric Company. Capital, $30,000. Incorporators: O. B. Stubbs, R. W. Stubbs and S. W. Peterson.

CLEVELAND, O.—Paramount Electric Company. Capital, $5,000. Incorporators: A. E. Fromholz, Benjamin Stern, H. L. Castle and others.

TOPEKA, KANS.—E. P. Jordan Electric Company. Capital, $10,000. Contracting and supplies. Incorporators: George R. Sheldon, Mrs. Hallie Jordan and others.

BUFFALO, N. Y.—Elmwood Construction Company. Capital, $10,000. Electrical contractors. Incorporators: H. S. Rankin, J. V. McGorray and W. W. Huntley, Electric Building, Buffalo.

NEW YORK, N. Y.—Hatzel & Buhler. Capital, $50,000. To engage as electrical contractors. Incorporators: C. Metzger, H. J. Kurrus and J. C. Hatzel, 89 West 119th Street, New York City.

SPRINGFIELD, O.—McDaniel & Campbell Electric Company. Capital, $25,000. Incorporators: William McDaniel, Roy J. McDaniel, Carl S. Campbell, Fred Campbell and R. E. McDaniel.

ST. LOUIS, MO.—General Lighting & Supply Company. Wholesale and retail electrical supplies. Capital, $5,000. Incorporators: Michael M. Cohen, Jacob D. Cohen and Joseph Cohen.

NEW YORK, N. Y.—Insulation Development Corporation. Capital, $5,000. Wire insulation, etc. Incorporators: Edward Rose, Eugene Lawler and Martin Dilion, 2 Broadway, New York City.

EAST PALESTINE, O.—Efficiency Electric Company. Capital, $30,000. Incorporators: Andrew Lukad, John Hudran, Martin Lipka, John Shraiber, Michael Mura and Johan Najpawer.

NEW YORK, N. Y.—Morrow Insulating Company, Inc. Capital, $25,000. Electrical contracting. Incorporators: J. J. and C. Morrow, 674 Academy Street, New York; H. M. Lewis, 2055 Washington Avenue, New York.

MILLBROOK, N. Y.—Milwaukee Electric Crane & Manufacturing Company. Capital, $335,000. Incorporators: M. P. O'Brien, Milwaukee, Wis.; Arthur Fritsch, Milwaukee, Wis., and Horace S. Gould, New York City.

NEW YORK, N. Y.—Victoria Electrical Appliance Manufacturing Company. Capital, $100,000. Incorporators: Herman Weber and Conrad Schickerling, Weehawken, N. J., and A. W. Schaab, 333 East 88th Street, New York City.

NEW YORK CITY.—Automatic Controller Corporation. Electrical apparatus. Capital, $10,000. Incorporators: G. G. Tusa, Brooklyn, N. Y.; Thorne Foster, Brooklyn, N. Y., and F. L. Harris, Elmhurst, L. I., N. Y.

CHICAGO, ILL.—Vapor Car Heating Company. At Albany, N. Y., with capital of $3,500,000. To manufacture lighting and heating equipment. Incorporators: S. B. Howard, W. Gold and O. R. Barnett, 1520 Monadnock Block, Chicago.

OGDEN, UTAH.—Redfield-King Company. Electric service and signs. Capital, $10,000. F. W. Redfield, president; Cleveland Redfield, vice-president; Carl Redfield, treasurer; William G. King, secretary, and Thomas Young, director.

MILLBROOK, N. Y.—Mitchell Vance Company. Capital, $105,000. Manufacture gas and electric fixtures. Incorporators: E. L. Steckler, 61 West 88th Street, New York City; A. W. Knauth, 302 West 76th Street, New York City, and W. A. Stevens, Brooklyn.

NEW YORK.—Case Specialty Company. Electrical specialties, etc. Capital, $4,000. Incorporators: Maurice Borrok, 1360 Boston Road, Bronx, N. Y., Maurice Silverberg, 94 Sheriff Street, New York City and Ralph Breslow, 1944 Coney Island Avenue, Brooklyn, N. Y.

Proposals

STEEL POLES.—Proposals will be received by the Commissioner of Gas & Electricity, Chicago, Ill., until April 2, for furnishing approximately 7,300 tubular steel poles and extensions, in accordance with specifications on file in the office of the commissioner, William G. Keith, Commissioner of Gas and Electricity.

ELECTRICAL SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., for furnishing supplies at the following naval stations: Schedule 849, Philadelphia, Pa., one electric windlass. Schedule 850, Philadelphia, Pa., one 15-horsepower and one 10-horsepower motor. Schedule 851, Brooklyn, N. Y., and Mare Island, Cal., 21 disc heaters and 14 ventilating fans. Schedule 856, Puget Sound, Wash., miscellaneous, ventilating fans. Bidders desiring to submit proposals should make application to the Bureau or to the nearest navy yard purchasing office.

Electrical Patents Issued March 20, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,219,432. Selenium Bridge and Method for Making Same. F. C. Brown, Berkeley, Cal. Electrodes engage crystal in way which permits light beam to impinge thereon.

1,219,450. Insulator. F. F. Fowle, Chicago, Ill. For supporting cables.

1,219,452. Toy-Motor Installation. A. C. Gilbert, assignor to A. C. Gilbert Co., New Haven, Conn. Arrangement of casing and gear-box.

1,219,459. Telephone Mouthpiece. S. M. Hino, Dander, Wyo. Details of structure holding disinfecting substance.

1,219,466. Method of Manufacturing Metal Articles by Deposit. H. C. Kirk, Jr., Roland Park, and G. H. Dumpler, Baltimore, Md. Arrangement of mold and electrode depository apparatus for manufacturing solid silver articles.

1,219,468. Electric Cutout Box. L. Kossoy, New York, N. Y. Special structure for pivoting cover to box.

1,219,470. Electric Switch. G. N. Lemmon, Greensburg, Pa. Movable contacts are carried on one of the links of a toggle.

1,219,480. Headlight. W. S. Perry, Chicago, Ill. Arrangement of transparent and semi-transparent portions in front glass.

1,219,497. Incandescent-Lamp Socket. M. V. Smith, assignor to J. E. Hamilton, Simsbury, Conn. Formed of main and auxiliary parts relatively rotatable to actuate contacts.

1,219,508. Means for the Regulation or Control of Railway and Like Traffic. H. Von Kramer, Edgbaston, Birmingham, England. Signal on car is inductively operated from conductor along track.

1,219,514. Means for Producing Colored-Light Effects. G. C. Whitney, New York, N. Y. Signaling system for railway use in which light of three or more colors is projected through a single uncolored lens.

1,219,517. Testing System. R. S. Wilbur, assignor to Western Electric Co., New York, N. Y. Wheatstone-bridge arrangement for measuring capacity.

1,219,518. Igniting and Lighting Generator. J. M. Wilson, assignor to Splitdorf Electrical Co., Newark, N. J. Structure of machine having separate igniting and lighting armatures.

1,219,519. Automatic Switching Mechanism. J. M. Wilson, assignor to Splitdorf Electrical Co. For use with above.

1,219,520. Electric Generator. J. M. Wilson, assignor to Splitdorf Electrical Co. Single unit having timer member and direct-current generating rotor geared, so that latter is driven at higher rate of speed than former.

1,219,522. Telegraph System. J. E. Wright, New York, N. Y. Composite system with transmitting and receiving telephone and current impulse operated mechanism.

1,219,528. Block-Signal System. H. W. Balcom, Worcester, Mass. For trolley lines; operated from trolley-actuated switches.

1,219,531. Telephone-Line Disconnector. M. S. Bricka, Milan, Ind. Structure and arrangement of knife-switch.

1,219,533 and 1,219,534. Refrigerating Machine. G. P. Carroll, Bridgeport, Conn. Valves are electrically controlled by thermostat.

No. 1,219,632.—Connector for Electrical Conductors.

1,219,548. Electric-Switch Mechanism. D. D. Gordon, assignor to Yost Electric Manufacturing Co., Toledo, O. For lamp sockets.

1,219,550. Antenna Structure on Aeroplanes for Wireless Signaling. W. Hahnemann, assignor to Firm Signal Gesellschaft, M. B. H., Kiel, Germany. Special arrangement and mounting of conductors.

1,219,554. Electric Signaling System. R. J. Hewett, Westfield, N. J. Details of block system.

1,219,560. Engine Starter. J. G. King, assignor to Splitdorf Electrical Co., Newark, N. J. Details of motor gearing.

1,219,561. Quadruplex Telegraphy. I. Kitsee, assignor to American Telephone & Telegraph Co., New York, N. Y. Method of quadruplexing cables.

1,219,562. Electric Fan and Generator. H. K. Kouyoumjian, assignor to Kemco Electric Mfg. Co., Cleveland, O. Has a radiator cooling fan and generating unit between engine and radiator.

1,219,563. Motor-Vehicle Construction. H. K. Kouyoumjian, assignor to Kemco Electric Mfg. Co. Related to above.

1,219,564. Electric Generator. H. K. Kouyoumjian, assignor to Kemco Electric Mfg. Co. Details of structure for above.

1,219,565. Commutator Construction. H. K. Kouyoumjian, assignor to Kemco Electric Mfg. Co. Structure of disk commutator for above.

1,219,569. Starting Mechanism for Hydrocarbon Engines. A. D. T. Libby, Orange, N. J., assignor to Splitdorf Electrical Co. Structure of gearing.

1,219,587. Telephone-Exchange System. J. N. Reynolds, assignor to Western Electric Co. Arrangement of test contacts, etc.

1,219,590. Spark-Plug. A. Schmidt, assignor to Champion Ignition Co., Flint, Mich. Details of device with gas chambers.

1,219,617. Galvanometer. W. H. Apthorpe, assignor to Taylor Instrument Co., Rochester, N. Y. Has plurality of fibers in magnetic field, the tension of which fibers can be independently adjusted.

1,219,620. Telephone Instrument. F. E. Bentley, Maplewood, Mo. Has amplifying horn connected with the receiver.

1,219,628. Headlight Dimmer. W. F. Conlan, Cleveland, O. Has special adjustable lens.

1,219,629. Method of Forming Electrical Heat Units. R. W. Davenport, assignor to Detroit Stove Works, Detroit, Mich. Resistor is shaped and spaced by destructible material secured in place by plastic material and the destructible material destroyed.

1,219,630. Starting Device for Internal-Combustion Engines. W. W. Dean, assignor to Garford Mfg. Co., Elyria, O. Connection between motor and engine controlled by manual means, which is rendered inoperative when engine is up to speed.

1,219,632. Connector for Electrical Conductors. E. B. Fahnestock, Plandome, New York. Comprises support with holding jaws and flexible metallic band, which is drawn tight on conductor. (See cut.)

1,219,648. Electricity Meter. R. C. Lan-

phier, assignor to Sangamo Electric Co., Springfield, Ill. A removable sleeve carries the pivot and damping disk.

1,219,650. Electric Toaster. E. N. Lightfoot, New York, N. Y. Details of upright structure.

1,219,656. Telephone System. T. G. Martin, assignor to Automatic Electric Co., Chicago, Ill. Arrangement of cord circuits, signals, etc.

1,219,666. Signaling System. H. O. Rugh, assignor to Railway Electric Mfg. Co., Chicago, Ill. A receiver is normally associated with the line, while such association of the transmitter is remotely controlled.

1,219,671. Device for Aiding the Hearing. E. W. Schneider, deceased, by Elizabeth C. Schneider, executrix, New York, N. Y. Microphonic transmitter with a variable rheostat.

1,219,679. Electric Barometer-Switch. P. E. Stoft, New York, N. Y. Details of special structure.

1,219,680. Ignition Mechanism. H. V. S. Taylor, assignor to Westinghouse Electric & Mfg. Co., New York, N. Y. Interrupter is electro-responsively shifted according to the speed.

1,219,687. Ignition System. B. Ames, Lowell, Mass. Structure of magneto.

1,219,693. Changeable Character Bulletin Apparatus. F. E. Bentley, Maplewood, Mo. Electro-pneumatically operated rotating signs.

1,219,700. Telephone-Exchange System and Apparatus Therefor. A. M. Bullard, assignor to Western Electric Co. Structure and arrangement of connection switch.

1,219,704. Ignition System. F. Conrad, assignor to Westinghouse Electric & Mfg. Co., New York, N. Y. Has a switch adapted to reverse the connections while the circuit is open at the interrupter.

1,219,713. Trolley-Retriever. A. D. Eberly, Spokane, Wash. Structural details.

1,219,727. Telephone Repeating System. E. Grissinger, assignor to American Telephone & Telegraph Co., New York, N. Y. For two-way talking.

1,219,732. Trolley-Wire Hanger. R. F. Hamilton, Wheeling, W. Va. Structure of device having universal adjustment.

1,219,733. Automatic Derailer. C. S. Hancock and G. W. Keller, Portsmouth, O. Intersecting railroad tracks have derailer in one electrically controlled by occupancy of other.

1,219,745. Electric Fan. E. Keen, assignor to The Aladdin Lamp Corp., New York, N. Y. Relates to jointed and universal support.

1,219,746. Insulator Bracket. L. F. Keppler, Harlan, Iowa. Sheet-metal pin supporting pole bracket.

1,219,749. Clock. H. C. Korfhage, New Albany, Ind. Motor-driven weight-lifting arrangements for rewinding.

1,219,760. Method of and Means for Correcting Loading Section Irregularities in Transmission Lines. J. Mills and R. S. Hoyt, assignor to American Telephone & Telegraph Co., New York, N. Y. For uniformly loading lines.

1,219,761. System of Control. R. C. Newhouse, assignor to Allis-Chalmers Mfg. Co. Electrically driven hoisting cars are inter-related with gate of supply bin.

1,219,769. Trolley-Pole-Positioning Mechanism. P. Pigache and C. E. Pigache, Paris, France. Cam device for bringing trolley pole into line with the wire.

1,219,775. Elevator-Signaling Apparatus and Circuits Therefor. C. A. Reiners, Hoboken, N. J. Floor push-button circuits controlled by car to give currents of different characters to operate different signals according to whether car is going up or down.

1,219,797. Art of Producing Aluminum Carbid. M. Barnett and L. Burgess, New York, N. Y. Details of process comprising heating of alumina and carbon by electrodes extending into mixture.

1,219,808. Electric Gear-Shifter. J. A. Capocefalo and R. L. Kino, Jr., Syracuse, N. Y. For automobiles.

1,219,833. Protector. D. T. May, assignor to Western Electric Co. Structure and insulation of electrodes of an air gap, for telephone ground circuits.

1,219,843. Water-Electrolyzing Apparatus. R. J. J. Mueller and E. G. Rowlands, assignors to Universal Oxygen Co. Structural details of cell.

1,219,850. Refillable Cartridge-Fuse. J. F. O'Bert, Los Angeles, Cal. Structural details.

1,219,862. Separable Insulator-Thimble Structure. C. L. Peirce, Jr., assignor of one-half to Hubbard & Co., Pittsburgh, Pa. Comprises threaded sheet-metal cap for securing to pin for engagement with insulator.

1,219,864. Cabinet for Panelboards. C. D. Platt, Bridgeport, Conn. Relates to a door-covering board having perforations to permit access and interchangeable slugs for indicating the apparatus corresponding to the perforations.

1,219,888. Combined Receiver and Detector for Wireless Use. F. Wallberg, New York, N. Y. Hand-carried receiving outfit comprising a telephone receiver and a crystal detector.

1,219,892. Display-Stand for Electric Light Lamps. C. W. Witt, Johnstown, Pa. Rotating table carries test lamps.

1,219,903. Electric Sealing-Wax Applying Device. F. M. Andrews, Columbus, O. Electrically heated hand-tool.

1,219,908. Universal Flush Receptacle and Plug. T. A. C. Both, assignor to the Zee Socket & Mfg. Co., Boston, Mass. For receiving threaded plugs of different diameters.

1,219,926. Electric Cooking Apparatus. F. V. Detwiler, Chicago, Ill. Details of thermostatic control of resistor circuit.

1,219,933. Electric Advertising Device. W. C. Gillespie, Phoenix, Ariz. Rotatable slide carrying disc is intermittingly rotated by thermostatically controlled solenoids.

1,219,940. Electric Heater. C. O. Harmon, Toledo, O., assignor of one-half to F. B. DeFrees, Toledo, O. A grid in a sheet-metal housing has special provision for promoting heat radiations.

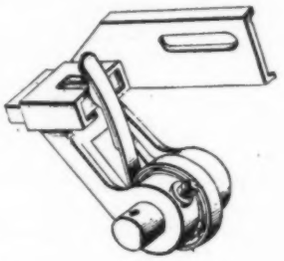
1,219,949. Electromagnetic Signal. W. Kaisling, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Comprises an electromagnetically operated signal-ball.

1,219,950. Thermostat. W. H. Kallenbach, Boston, Mass. Details of contact device.

1,219,952. Alternating-Current Motor. W. C. Korthals-Altes, assignor to General Electric Co. Polyphase commutator structure.

1,219,955. Quadruplex Telegraphy. I. Kitsee, assignor to American Telephone & Telegraph Co. Details of the method employing impulses of opposite polarity.

1,219,961. Means for Indicating Electrical Characteristics of Alternating Currents. I. Langmuir, assignor to General Electric



No. 1,220,082.—Brush-Holder.

Co. Special structure and arrangement of anodes, cathodes, etc., in a vacuum tube.

1,219,966. Electrolytic Gas-Generator. I. H. Levin, Newark, N. J. Has 56 claims to various structures and arrangements of features of an electrolytic cell.

1,219,979. Battery-Tongs. M. Melia, assignor to Commercial Truck Co. of America, Philadelphia, Pa. Details of special structures.

1,220,005. Wireless Signaling System. J. H. Rogers and H. H. Lyon, Hyattsville, Md. Has its antenna parallel to and buried under the surface of the earth.

1,220,011. Electrically Controlled Valve-Mechanism for Motors. S. Scognamillo, New York, N. Y. For internal-combustion engines.

1,220,036. Signal Apparatus. J. Weigel, Boston, Mass. Details of impulse-transmitting signal-box.

1,220,041. Water-Level Alarm. H. L. Witt and S. Lookman, Pittsburgh, Pa. Cabinet containing battery, contacts and alarm.

1,220,054. Armature-Banding Machine. G. E. Austin and F. Lachance, Brooklyn, N. Y. Structure of machine.

1,220,062. Trolley-Wire Hanger. F. A. Bean, Carrollton, O. For clamping to a spanner wire.

1,220,063. Arc-Lamp. A. Blondel, Paris, France, assignor to General Electric Co. Special structure and arrangement of arc-enclosing globe, gas vents, reflector, etc.

1,220,066. Telegraph Apparatus. H. M. Boal, Titusville, Pa. Arrangement of relay control of local circuits and main-line resistance in normally closed telegraph line.

1,220,072. Method of Wireless Signaling. L. Cohen, Washington, D. C. Relates to an arc system comprising two oscillatory circuits of different time constants shunted across it.

1,220,082. Brush-Holder. D. B. Flower, Glenside, Pa. For dynamos and motors; structural details. (See cut.)

1,220,089. Signal System for Railways. W. H. Gilman, Boston, Mass. Fusee torches of different colors are electrically controlled by trains.

1,220,101. Electric Starting and Generating Apparatus. E. A. Halbleib and F. F. Dorsey, assignors to North East Electric Co., Rochester, N. Y. Comprises a motor-generator and a storage battery.

1,220,109. Electric Display System. A. C. Heiny, assignor to Heiny Electric Co. Control of monogram signs.

1,220,110. Electric Display Apparatus. A. C. Heiny, New York, N. Y. Modification of above.

1,220,124. Internal-Combustion Engine. J. W. Hoffner, Salisbury, N. C. Has special arrangement of ignition mechanism.

1,220,139, 1,220,140 and 1,220,141. Circuit-Connector. H. A. Douglas, assignor to Douglas & Rudd Mfg. Co., Bronson, Mich. Structure of contact-carrying sleeve for connecting lamp base and plug.

1,220,152. Fuse Device. N. J. Conrad, assignor to Schweitzer & Conrad, Chicago, Ill. An enclosed and immersed fuse has its movable terminal movable at right angles to fuse.

Reissue 14,273. Signaling System. C. E. Beach, Binghamton, N. Y., assignor to Gamewell Fire Alarm Telegraph Co., Newton, Upper Falls, Mass. For fire-alarm circuits.

Reissue 14,274. Electrical Installation for Lighting, Heating and Ventilating Railway-Carriages and for Similar Purposes. A. H. Darker, assignor to J. Stone & Co., Ltd., London, England. Arrangement of switch gear and revisible shunt-wound dynamo.

PATENTS EXPIRED.

The following United States electrical patents expired on March 27, 1917:

645,933. Telephone. M. Beck and E. Ferrant, Minneapolis, Minn.

645,943. Dynamoelectric Machine. G. Dalen and A. Hultquist, Stockholm, Sweden.

645,958. Telephone System. A. K. Keller, Philadelphia, Pa.

645,959. Telephone Receiver. A. K. Keller.

645,960. Telephone Transmitter. A. K. Keller.

645,978. Secondary Battery. W. L. Silvey, Dayton, O.

645,984. Electrical Switch. J. C. Tournier, Schenectady, N. Y.

645,990. Trolley Wheel. R. S. Windsor, Alexandria, Va.

645,992. Primary Battery. F. B. Badt, Chicago, Ill.

646,001. C. A. Harkness, Providence, R. I.

646,009. Device for Electrical Connections. M. Pfatischer, Philadelphia, Pa.

646,013. Automatic Time-Stamp. N. H. Suren, Newton, Mass.

646,036. Electric Time-Alarm. H. Reich, Bozen, Austria-Hungary.

646,068. Electric Switch. J. L. Creveling, New York, N. Y.

646,092. Dynamoelectric Machine. B. G. Lamme, Pittsburgh, Pa.

646,100. Thermostat. C. B. Rogers, Stevenson, Md.

646,110. Ammeter. P. H. F. Spies, Yonkers, N. Y.

646,114. Portable Electric Lamp. A. F. Vetter, New York, N. Y.

646,121. Duplex Multiple Metallic Telephone System. F. C. Hughes, Detroit, Mich.

646,124. Combined Telephone and Vending Machine. C. H. Kraft, Salt Lake City, Utah.

646,146. Snap-Switch. G. W. Hart, West Hartford, Conn.

646,147. Electric Motor. H. F. Joel, London, England.

646,149. Method of Protecting Electrical Connections. J. Langton, New York, N. Y.

646,150. Electrical Connector. J. Langton, New York, N. Y.

646,155. Electrical-Railway Switch. P. E. Perry, Boston, Mass.

646,169. Apparatus for Electrically Controlling Engines, Electromotors or Other Machinery. W. H. Harfield, London, England.

646,179. Electric Coupling. R. D. Ireland, Winthrop, Mass.

646,222. Electric Bell. F. Keil and H. F. Keil, New York, N. Y.

646,229. Surface-Contact System of Electric Railways. R. Lundell.

646,307. Vessel Indicator. A. L. McCormick, Port Huron, Mich.

646,308. Automatic Regulator for Alternating Dynamos. G. S. Neeley, Pacific, Mo.

646,309. Induction Motor. G. S. Neeley, Ferguson, Mo.

646,325. Battery Jar or Receptacle. E. A. Sperry, Cleveland, O.

646,348. Secondary Battery. H. Blumenberg, Jr., and F. C. Overbury, New York, N. Y.

646,362. Rontgen-Ray Apparatus. J. M. Davidson, London, England.

Design 32,396. Filament for Incandescent Electric Lights. H. B. Husselman, Worcester, Mass.